Providing and evaluating evidence – based water, sanitation and hygiene behavioral interventions for prevention and control of cholera

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Abstracts

This work is situated within the environmental and health psychology research on human behavior change. Three consecutive studies deal with the question of behavior change in the context of at-risk population for cholera epidemics in a low-income country setting in Central Africa.
Participants in the presented studies were interviewed regarding their drinking water treatment practices and what think of this behavior in terms of cholera prevention activities. Psychological aspects were examined using the Risk, Attitudes, Norms, Abilities, and Self-regulation model for behavior change.
This research aims at understanding drivers and barriers for the uptake of drinking water treatment technologies for disease prevention, specifically focusing on the user perspective. It further evaluates a specific campaign targeting the promotion of chlorination for drinking water disinfection at household level in several communities along the Lake Chad Basin. The presented approach and results could be used to study the adoption and promotion of other water treatment technologies in similar settings for the development of appropriate behavior change strategies.

Diese Arbeit ist in der umwelt- und gesundheitspsychologischen Forschung zur Veränderung des menschlichen Verhaltens situiert. Drei konsekutive Studien beschäftigen sich mit der Frage der Verhaltensänderung im Kontext einer Risikopopulation für Choleraepidemien in einem Land mit niedrigem Einkommen in Zentralafrika.
Die Probandinnen in den vorgestellten Studien wurden hinsichtlich ihrer Praktiken zur Trinkwasseraufbereitung befragt und was dieses Verhalten in Bezug auf Cholera-Präventionsaktivitäten für sie bedeutet. Psychologische Aspekte wurden unter Verwendung des Risiko-, Einstellungen-, Normen-, Fähigkeiten- und Selbstregulations-Modells für Verhaltensänderungen untersucht.
Diese Forschung zielt darauf ab, die treibenden Kräfte und Barrieren für die Annahme von Technologien zur Trinkwasseraufbereitung für die Krankheitsprävention zu verstehen, wobei der Schwerpunkt auf der Anwenderperspektive liegt. Ferner wird eine spezifische Kampagne zur Förderung der Chlorierung zur Trinkwasserdesinfektion auf Haushaltsebene in mehreren Gemeinden entlang des Tschadseebeckens evaluiert. Der vorgestellte Ansatz und die Ergebnisse könnten genutzt werden, um die Akzeptanz und Förderung anderer Wasseraufbereitungstechnologien in ähnlichen Umgebungen für die Entwicklung geeigneter Verhaltensänderungsstrategien zu untersuchen.

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"It is wise to bring some water when one goes to look for water."

Arab Proverb

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List of Abbreviations

CSSI	**C**entre de **S**upport en **S**anté **I**nternationale
HWTS	**H**ousehold **W**ater **T**reatment and **S**afe storage systems
IBM WASH	**I**ntegrated **B**ehavioral **M**odel for **W**ater **S**anitation and **H**ygiene
MSP	**M**inistère de la **S**anté **P**ublique
RANAS model	**R**isk **A**ttitude **N**orms **A**bility **S**elf–regulation model
WaSH	**W**ater **S**anitation and **H**ygiene
WBG	**W**orld **B**ank **G**roup
WHO	**W**orld **H**ealth **O**rganisation

0.1 Summary

Inadequate drinking water accounts for millions of diarrheal cases yearly and represents a major cause of deaths among children in developing countries. Cholera alone accounts for up to 130,000 deaths annually. Worldwide, over 600 million people lack access to safe drinking water sources and even more consume water that is contaminated.
Household water treatment technologies provide an intermediate solution where access to safe drinking water sources is lacking. While several options for point-of-use water treatment exist, they all require behavioral adaptation by the consumer. Only the correct, consistent and continued application guarantees expected health benefits. Effective behavior change strategies can help to promote the uptake and sustained use of water treatment at the household level.
A framework is presented here to identify contextual, psychological, and technological factors for several point-of-use water treatment technologies which can be used to understand and promote drinking water treatment behavior in the development work context. Three studies are showcased on the development and testing of behavior change strategies for the promotion of drinking water chlorination in the Lake Chad Basin.
Three major research questions are addressed within this work: What are relevant contextual and psychological factors for drinking water chlorination in targeted communities? Which psychological factors are important for sustained water treatment behavior? And can the adoption of drinking water treatment be encouraged with a campaign targeting identified factors? Three surveys were conducted among a highly at-risk population for future cholera epidemics. Interviews were conducted among primary caregivers of small children in several communities in the project region. The survey tools and a subsequent behavior change campaign were designed based on the Risk, Attitude, Norms, Abilities, and Self-regulation model for behavior change.
Study 1 assessed current water treatment practices and related respondents' mindsets to understand drivers and barriers for the uptake of household drinking water chlorination. It was found that only a minority of households were engaged in water treatment and knowledge about treatment options was rather low. Several psychological factors from the risk, norm, and ability components were identified as relevant for behavioral adoption.
Study 2 examined how these psychological factors evolved over time to understand what are relevant factors for long-term usage of chlorination. Factors for sustained use were primarily from within the norm component, perceived abilities in performing treatment over time, and action control.
Study 3 evaluated an intervention campaign promoting the uptake of chlorination at the household level. The campaign was based on the findings from the first study and used a systematic approach combining several behavior change techniques linked to the identified factors. Results indicate that treatment behavior could be enhanced among intervention participants and also non-participants from within the same communities. Increased health knowledge, a heightened personal norm and social support strategies, together with improved action knowledge, and perceived self-efficacy positively influenced the uptake of chlorination behavior.
This research shows how a theory-based, systematic approach to behavior change can be used to identify relevant behavioral factors for the adoption and sustained usage of water treatment technologies. These were demonstrated to be positively affected by a systematic behavior change campaign and increased the adoption rate

of drinking water chlorination in an at-risk population. The presented approach could be used to study other water treatment technologies for the development of appropriate behavior changes strategies.

Chapter 1

Introduction

1.1 Cholera

Cholera is an infectious disease caused by the bacteria vibrio cholerae inducing common symptoms of diarrheal disease such as watery stools, but also vomiting and cramps. As a consequence this can lead to extreme dehydration with diverse complications, and eventually results in the death of a patient if not properly taken care of (Bennish, 1994). Children under the age of five years are most sensible to the risks and are overrepresented in diarrheal related deaths worldwide (Prüss-Ustün et al., 2014).

Treatment is fairly straightforward using oral rehydration therapy (ORT), supplying enough liquids to balance the body's water household, supplemented with electrolytes, but also sufficient intake of nutrition (Carpenter, 1992; Guerrant, Carneiro-Filho, & Dillingham, 2003). Antibiotics can also be given to shorten the duration of the infection, however, increasing antibiotic resistance has been observed over the last years (Sack, Sack, & Chaignat, 2006).

1.1.1 Cholera worldwide and in the Lake Chad region

Globally, an estimated 3–5 million cases and up to 130.000 cholera related deaths are reported yearly (GBD 2015 Mortality and Causes of Death Collaborators, 2016; WHO, 2016), with around 80% of all cases appearing in African countries (Naidoo & Patric, 2002). The two countries of Tchad and Cameroon alone experienced over 60.000 cases in 2010 and 2011 together (WHO, 2012) which led the government to call for a response to quickly respond to epidemics and to prevent future outbreaks. Cholera has been endemic in the region for a long time (Naidoo & Patric, 2002). The region around Lake Tchad is known as one of the cholera hot spots worldwide which has been repeatedly struck by cholera epidemics in the last decades with cyclically recurring episodes of yearly or biennial outbreaks (Richard, Tosi, Arzel, & Kana, 1999; WHO, 2016).

It displays typical environmental characteristics that favor outbreaks with recurring episodes (Jutla et al., 2013). Long periods of droughts alter with heavy rains during the summer months of the year. During the dry season, large bodies of water often last throughout the year in which the vibrio outlasts and finds good conditions to breed and multiply. Vibrio cholera is present mostly in stagnant but also fluid water bodies and can survive extreme conditions such as long periods of droughts and high temperatures, even salinity is not problematic but rather favorable to its survival (Siddique et al., 1991). The pathogen can be isolated from different water bodies during all seasons (Akoachere & Mbuntcha, 2014). With the onset of the rainy season in May/June, the pathogen is reactivated and quickly spreads through the overflowing water bodies into river beds, ponds, and shallow wells which are not

properly protected. Even quarters of Chad's capital N'Djamena suffer from yearly inundations during and in the aftermath of the rains. This is usually the season when cholera outbreaks occur and spreads throughout the region. Epidemics follow a seasonal trend and coincide with the rainy seasons with a pattern of rising temperatures at the beginning and increased rainfall following, both increasing the relative risk of an outbreak (Jutla et al., 2013; Luque Fernández et al., 2009; Siddique et al., 1991).

1.1.2 Cholera related risk factors

The risk for cholera infections and transmission can be understood as a combination of environmental circumstances and individual level behavior (Sasaki, Suzuki, Igarashi, Tambatamba, & Mulenga, 2008).

The Lake Chad region is known for its trans-border movement of people and goods. Traditional fisherman cross the rivers to sell their catch in the nearby markets on both sides of the boarder. Coming from the south, the roads crossing the Cameroonian-Chadian boarder constitute some of the major trading routes between the port in Douala, Cameroon, the forests in the South, and N'Djamena, Chad's capital which brings a lot of movement into the region. Cholera has been repeatedly described to be imported into one country from one side or the other of the neighboring border states and thus quickly spreads across the borders. Population displacement and dense neighborhoods are described as particularly risky in combination with structural difficulties of providing access to safe water and sanitation (Oger & Sudre, 2011). Further, a weak health care system with long distances leading to delayed access to health care facilities are described in the literature as unfavorable (Richard et al., 1999). Another risk factor for cholera epidemics are refugee streams coming into the country, sharing dense room with often weak Water, Sanitation, and Hygiene (WASH) infrastructure (Naidoo & Patric, 2002). As Chad is one the major recipients of refugees from neighboring states, a number of camps are situated close to the borders in the East near the Sudanese border, towards the South facing the Central African Republic, and towards the west where more and more refugees from Nigeria are entering the country.

A number of environmental and infrastructural risk factors exist in the region. Among these are unprotected water sources such as traditional (hand) dug wells (Oger & Sudre, 2011) or surface water sources which often represent the only nearby available water sources in many rural areas. As described above, the seasonality of heavy rains paired with long periods of hot and dry weather represent a typical climatic predisposition for the spread of endemic cholera pathogens.

On the human side, some behaviors have been described in relation to cholera risks and its transmission. Oger and Sudre (2011) describe how traditional funeral practices among Muslim neighborhoods can act as a risk behavior which is quite common in the country. During traditional funerals, usually a large group of people, including large families, friends, and neighbors who join together, share very little room e.g. around the mourning family's house where they live, eat, and sleep together during several days. Open defecation and the inadequate disposal of human waste as well as non-exisiting standard procedures for the treatment of water sources represent additional risk factors for cholera epidemics (UNICEF, 2012).

FIGURE 1.1: Geographic layout of study sites (black dots) in south-western Chad bordering the extreme north region of Cameroon along the two river systems Chari and Logone within the Lake Chad basin.

1.1.3 Prevention measures against cholera

The most effective way to fight cholera next to an early response to outbreaks is its prevention (UNICEF, 2012). Compared to ad-hoc measures that are designated to quickly respond to an outbreak, preventative work has become the focus of many development projects and governments.

A number of oral cholera vaccines have been developed and are available in over 60 countries (Sinclair, Abba, Zaman, Qadri, & Graves, 2011) with around 50% efficacy at least during the first year (Graves, Deeks, Demicheli, & Jefferson, 2010). Injected vaccines are known to be more effective, but their availability is limited. Both vaccines have shown less efficacy in children under the age of five. To date, the World Health Organization (WHO) recommends vaccination only in high-risk groups (WHO, 2010) although herd immunity can be achieved with the result of decreased contamination of the environment as well (Sack et al., 2006).

Common and effective cholera prevention measures on the behavioral side are

frequent hand washing with soap, use of latrines, and disinfection of drinking water (Dubois, Sinkala, Kalluri, Masaka-Chikoya, & Quick, 2006; Sasaki et al., 2008). Two of the most promising measures to prevent cholera outbreaks and its transmission is the creation of access to functional sanitary infrastructures and safe drinking water (Waldman, Mintz, & Papowitz, 2013). However, for the Lake Chad basin, Oger and Sudre suggest that the access to an improved water source seems to be the most promising protective factor, while they found no clear effect of sanitation (Oger & Sudre, 2011).

1.2 Safe drinking water

Safe drinking water is a human right and fundamental requirement for good health (UN, 2010). Access to safe drinking water is being monitored worldwide and data shows that over 600 million people use sources that are not yet improved (WHO & UNICEF, 2010). However, the number of people consuming safe drinking water is likely to be overestimated because water from improved sources is not necessarily safe to drink (Bain, Cronk, Wright, et al., 2014; Onda, LoBuglio, & Bartram, 2012; Sobsey, Stauber, Casanova, Brown, & Elliott, 2008). Many sources declared as improved contain fecal contamination as shown in a review over 319 individual studies - especially in low-income countries and rural settings (Bain, Cronk, Wright, et al., 2014). In addition, even if the water drawn at the source is of good quality, numerous sources of potential recontamination exist during transport and storage, and through consumption habits (e.g. contaminated transport or storage containers, dipping hands into stored water or sharing the same cup for scooping).

Inadequate water that is not safe to drink constitutes one of the greatest risk factors for diarrheal disease and accounted for around a third of approximately 842.000 diarrheal deaths in 2012 due to inadequate water, sanitation, and hygiene practices (Prüss-Ustün et al., 2014). The consistent consumption of safe drinking water can significantly reduce the burden of diarrheal disease although there is some debate around the degree of effectiveness of different treatment technologies, mostly due to their incorrect or inconsistent application (Boisson et al., 2013; Clasen, 2015; Hunter, Zmirou-Navier, & Hartemann, 2009; Ojomo, Elliott, Goodyear, Forson, & Bartram, 2015; Wolf et al., 2014).

Where no adequate infrastructure exists, the individual has to evaluate his or her possibilities to create a positive, protective environment for her or himself, one's family, and community. Household water treatment and safe storage systems (HWTS) represent an intermediate off-the-grid solution for such settings and can increase the quality of water at the point of use (POU) (Wolf et al., 2014). Significant reductions of diarrheal prevalence can be expected from HWTS usage, and it is one of the most important means for prevention (Arnold & Colford, 2007; Cairncross et al., 2010; Clasen, Haller, Walker, Bartram, & Cairncross, 2007). The health benefits from POU treatment methods might even exceed those that can be expected from improvements at the source level (due to the problem of recontamination) (Sobsey et al., 2008).

1.2.1 Drinking water disinfection methods

Several options exist for water treatment at the point of use, which is at the household level where the water is also consumed. Water designated for drinking and

FIGURE 1.2: Typical way of storing drinking water in rural Chad
(Picture by Jonathan Lilje)

the preparation of food, but also for safe handwashing can be purified by boiling, disinfection, or filtration (Sobsey et al., 2008), among others.

Boiling Water can be sterilized by heating it up to boiling point for a certain amount of time before letting it cool down. This is microbiologically very effective against all kinds of waterborne pathogens (WHO, 2011). Boiling is probably the oldest and one of the most common options used for drinking water treatment around the globe (Clasen, Thao, Boisson, & Shipin, 2008; Gadgil, 1998; Ojomo et al., 2015). Although in widespread application, boiling is very energy-intensive. Boiling all water designated for consumption within a household is oftentimes not economically feasible and can demand large shares of the available household income when large quantities of fuel have to be purchased regularly (Gilman & Skillicorn, 1985; Psutka, Peletz, Michelo, Kelly, & Clasen, 2011). Gathering enough firewood is a time-consuming and burdensome work of millions of women around the globe (Cecelski, 1987). In addition, indoor air pollution from burning biomass fuels can cause severe side-effects especially on children's health such as respiratory infections and represents another problem on its own (K. Smith, 2013; E. M. Smith, Plewa, Lindell, Richardson, & Mitch, 2010). Water that has been boiled is also not protected from recontamination, and therefore requires rigorous safe storage practices.

Filtration Filtration is the process of physical removal of dirt and pathogens through porous membranes, sand, or cloth. According to an evaluation study of different POU technologies, ceramic and biosand filters show reliable effectiveness in improving drinking water quality and users' health in the long-term and have the greatest potential to become widely used in developing countries (Sobsey et al., 2008).

Different types of filters can be used for water purification, starting from the use of simple cloth for filtration, to ceramic or fiber membranes and biosand filters. However, the principle is always the same of physically removing dirt particles and biological components including pathogens by passing the water through microbiologically small openings or pores. These are retained inside the filter while only the purified water exits the filter on the clean side. Ceramic filters for example are produced locally in many developing countries and their microbial effectiveness varies with production methods and quality of the material (Sobsey et al., 2008). Biosand filters in addition contain a biologically active layer which enhances the effectiveness deactivating certain pathogens.

Chlorination of drinking water Disinfection of drinking water can be achieved using chemical substances. Chlorine is a widely available, easily produced, and low-cost chemical that is used to render water safe for consumption. Chlorine can be purchased in different forms, such as liquids (household bleach), or solid in the form of powder or tablets designed to treat a fixed quantity of water. The usage of chlorine at POU has been widely recommended by the U.S. Centers for Disease Control (CDC) (Sobsey et al., 2008). Chlorine is also added into piped water systems in many countries around to prevent the contamination of the transported water. Chlorination is effective against bacteria and viruses, and to a lesser extent against protozoa (Sobsey et al., 2008). Chlorine is especially effective against cholera, why it is often distributed in the emergency context during or prior to feared cholera outbreaks. It is however not effective against some classes of pathogens such as Cryptosporidium (WHO, 2011). The amount of chlorine necessary to be added also depends on the quality of the water. High turbidity of the raw water might reduce its effectiveness, needs higher dosages, and is recommended to be filtered first. A contact time of around 30 minutes is usually sufficient to effectively disinfect the treated water, but can depend also on the quality and temperature of the water (WHO, 2011).

One of the main advantages of chlorine over other treatment technologies is that it provides lasting protection from recontamination due to the free chlorine in the water that can disinfect contaminating elements that are introduced into the water at a later point. The crucial point in using chlorine is to dose the correct amount of disinfectant to a given quantity of water. While under-dosing results in a reduced efficacy to kill microbiological pathogens, adding too much chlorine can induce a strong, sometimes bitter taste and odor to the water, which can lead to rejection by consumers (Freeman, Quick, Abbott, Ogutu, & Rheingans, 2009; Luby, Mendoza, Keswick, Chiller, & Hoekstra, 2008). There is quite a grown discussion around the toxicity of chemical disinfection by-products which can result from adding chlorine into drinking water (Luilo & Cabaniss, 2011; K. Smith, Samet, Romieu, & Bruce, 2000; Chu et al., 2015). However, the current WHO guideline for drinking water quality rates the risk of these by-products to be largely outweighed by their benefits and therefore recommends treatment using chlorine within set dosage limits (WHO, 2011).

Coagulation-flocculation Chlorination is sometimes combined with a coagulant, which chemically binds to the disinfected material in the water leading to its sedimentation. This is one of the more expensive technologies (McGuigan et al., 2012), and usually only available where it is specifically distributed during epidemics. These materials come in the form of tablets or sachets for a fixed amount of water.

SODIS SODIS is a very simple, low-tech technology that uses sunlight to disinfect water. The water is placed in clear plastic or glass bottles and exposed to the sun for several hours, during which radiation from the UV–A spectrum in combination with increased temperatures improve the microbiological quality of the water. However, the water has to be clear for the sunlight to effectively pass through, which means that turbid water needs to be filtered before it is exposed to the sunlight (Sommer et al., 1997; Wegelin & Sommer, 1998).

SODIS has been extensively studied over the last decades and has been shown to effectively reduce almost all waterborne pathogens, both under laboratory conditions and in field studies (McGuigan et al., 2012). Its impact on health and diarrhea

reduction has been subject to quite some discussion, but clinical trials show significant reductions of illness when used correctly and consistently. Although SODIS has been the least prevalent technology among households using HWTS, it is in use in over 50 countries around the globe by an estimated 4.5 million people (McGuigan et al., 2012). Among the range of existing options, SODIS is potentially the cheapest technology needing the least resources on the consumer's side (Clasen, Haller, et al., 2007).

Other technologies There are a number of other POU water purification technologies (e.g. using ozone), which are less common, oftentimes requiring a higher technological standard and are thus incongruous to household settings in less developed regions. These options will therefore not be addressed further in this work.

1.3 Consumer behavior

The success of HWTS technologies in providing safe drinking water for the prevention of disease does not solely rely on the microbiological efficacy of the treatment method to remove threats, but also on their correct, consistent, and continuous usage (Clasen, 2015). Slight reduction in adherence are shown to lead to a rapid decrease in the expected health benefits from POU technologies (Brown & Clasen, 2012). Therefore, the application and consistent usage of treatment products and technologies almost exclusively rely on the consumer's behavior. In consequence, it is essential to understand the drivers, motivators, and factors which operate within people's mindsets that steer or determine an individuals' choices and behaviors (WBG, 2015).

Consumer's behavior can be understand from different perspectives within the social sciences such as sociology, economics, political sciences, and other. When it comes to health relevant behaviors, psychological approaches from within the class of behavioral sciences offer a number of tools and theories, as well as evidence on how the individual works and makes up his or her mind about different behavioral options.

1.3.1 The RANAS model

While understanding what drives people in their decision making is one aspect, changing underlying factors of behavior is the next step in projects aiming to motivate people to modify existing practices towards healthier alternatives (Conner & Norman, 2005). Based on a range of well-established health psychological theories such as the Health Belief Model (Rosenstock, 1974), the Theory of Planned Behavior (Ajzen, 1985) and the Health Action Process Approach (Schwarzer, Lippke, & Ziegelmann, 2008), the Risk, Attitude, Norms, Ability, and Self-Regulation (RANAS) model has been especially developed to understand individual's motivations and attitudes concerning health relevant behaviors in the context of developing countries (Mosler, 2012). This conceptual guideline not only provides a set of factors that should be systematically measured within a target population but also indicates which type of behavior change techniques (BCTs) should come into practice to effect systematic changes in the targeted behavior (Michie, Johnston, Francis, Hardeman, & Eccles, 2008; Mosler & Contzen, 2016). Their successful implementation has been demonstrated in projects across the globe on different Wash behaviors such as SODIS usage, switching to alternative safe drinking water sources, monitoring well water quality, and cleaning of water storage containers, latrine construction, usage,

and maintenance, as well as handwashing in different contexts (Contzen, Meili, & Mosler, 2014; Huber, Tobias, & Mosler, 2012; Inauen & Mosler, 2013; Kraemer & Mosler, 2012; Stocker & Mosler, 2015; Tumwebaze & Mosler, 2015).

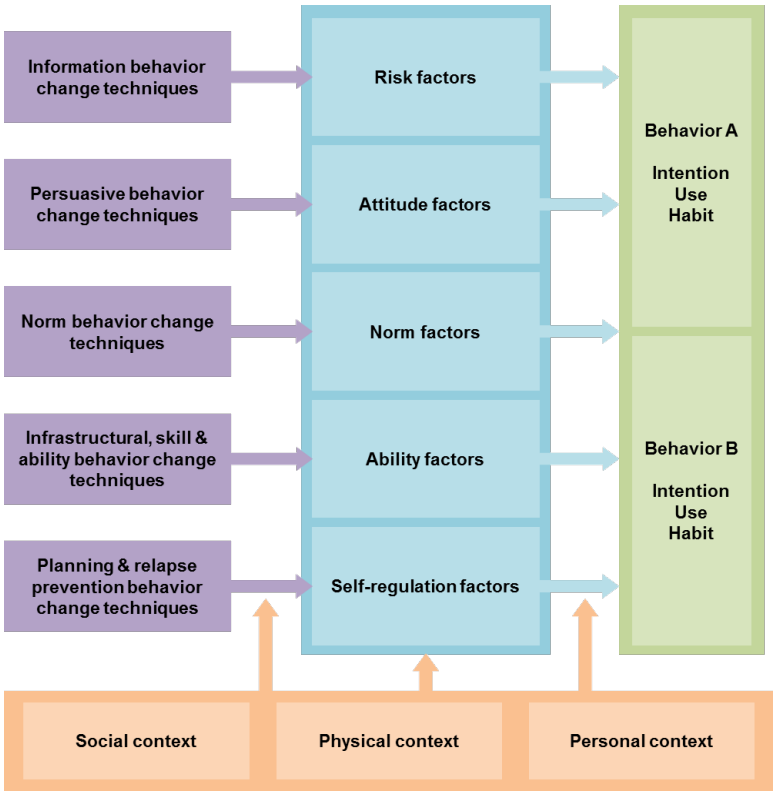

FIGURE 1.3: The Risk, Attitudes, Norms, Ability, and Self-regualtion model as in (Mosler, 2012)

The RANAS model groups factors from different health psychological theories into five different categories, or factor blocks, which according to the model are simultaneously important for health behavior (see Figure 1.3).

Risk factors contain all the factors affecting an individual's understanding and awareness of health risks. Perceived vulnerability refers to the subjective awareness of the risk of contracting a disease. Perceived severity is the perception of the seriousness of the consequences of contracting a disease. Health knowledge refers to the understanding of how someone could be affected by a disease, for example knowing the pathways for potential contamination with pathogens.

Attitudinal factors express a positive or negative stance towards a behavior. Instrumental beliefs concerning a behavior include beliefs about monetary, timely, and personal efforts and gains, possible savings, and health consequences. Furthermore, attitudes have an affective component (affective beliefs) relating to feelings arising when someone performs or thinks about a behavior.

Normative factors represent perceived social pressures with respect to a particular behavior. They can be determined by observing the behavior of others (descriptive norm) and refer to perceptions of behaviors typically performed by others. In contrast, others' declarations of approval or disapproval (injunctive norm) reflect perceptions of behaviors typically supported or not supported by relatives, friends or neighbors. Approval by others includes institutional norms, the "dos and dont's" expressed by recognized authorities such as traditional and religious leaders and

other institutionalized norms. Finally, the personal norm conveys what an individual believes she or he should do and its personal importance.

Ability factors represent aptitudes that individuals believe they must possess to fulfill the desired behavior; they represent a person's confidence in being able to perform a behavior. One precondition, the how-to-do knowledge (action knowledge), is that the people concerned know how to perform the behavior. The perceived ability to perform (self-efficacy) corresponds to confidence in one's ability to organize and execute the courses of action required to manage situations in which the new behavior is required. The perceived ability to retain a new behavior (maintenance self-efficacy) includes beliefs about one's confidence in being able to deal with barriers that arise to keeping up the behavior. The perceived ability to rebound (recovery self-efficacy) describes one's confidence in recovering from setbacks.

Self-regulation factors are responsible for the continuation and maintenance of a behavior; they help the person to manage conflicting goals and distracting cues when intending to implement and continue a behavior. Action planning represents ideas about how to set up the behavior by specifying it's when, where, and how, and action control refers to strategies of ongoing monitoring and evaluation with regard to behavioral standards. Barrier planning (coping planning) means that the person has to have plans to overcome barriers which would impede the behavior. Finally, the person should remember the behavior in the right situation and has to be committed to performing it.

The behavioral factors (middle column in Figure 1.3) in the RANAS model determine the behavioral outcome. Whether a certain behavior is performed or not or to what extent depends on the individual's mindset captured by these different factors. Use describes a person's actual behavior, intention describes a person's motivation or "readiness" to perform a behavior, and habit refers to the level of routine with which a behavior is executed (Mosler, 2012).

For example, an individual who thinks that using chlorine to treat drinking water is affordable (compared to the alternatives of not treating or paying for medical costs in the case of illness) and beneficial in terms of its impacts on health is more likely to actually buy chlorine and perform water treatment, or at least be willing to do so in the future compared to somebody who thinks the same is expensive and will not have many positive effects.

Once relevant psychological factors for the behavior under study have been identified, corresponding behavior change techniques (BCTs) can be selected to influence these factors (left column of the model, Figure 1.3). These BCTs can be selected and designed to specifically address selective psychological factors within the targeted population to promote behavior change into the desired direction (e.g. not drinking raw water, but treating drinking water at the household level).

To stick with the previously mentioned example, if the perception of costs and benefits are relevant factors for the water treatment behavior of a given sample population, then persuasive BCTs should be selected and used to address these attitudinal factors.

In addition to the psychological factors, environmental characteristics and contextual circumstances can influence the practicability, availability, and usability of different HWTS technologies in a given setting, and should thus be considered when thinking about the promotion of health relevant behaviors (e.g. the usage of different water treatment options). These are also included in the RANAS model.

1.4 Objectives of this thesis

The objectives of this thesis are twofold. The first objective will be to develop a framework for the decision making on the promotion of appropriate HWTS technologies from a psychological perspective. Different aspects of using one or another tehcnology shall be discussed from a psychological perspective. This work is presented in the introduction chapter in the following section.

A second objective will be to document the application and testing of the RANAS model in the specific context of cholera prevention by promoting household drinking water chlorination in communities in the Lake Tchad Basin. A campaign was developed and tested based on baseline research according to the proposed procedure in the RANAS approach (Mosler, 2012; Mosler & Contzen, 2016). The effects of this campaign on the target behavior in the study sample were then evaluated and psychological mechanisms of behavior change examined. This process is described in Chapters 2, 3, and 4.

1.5 Decision making framework: Psychological profiles of different safe water technologies

As different water treatment options are available as described above, the choice on which technology might be appropriate for a specific setting and target population does not solely rely on their technological and microbiological aspects, but also on their psychological profile for users. Three different treatment options shall be compared in terms of their behavioral requirements for the user to help implementers in their decision making on which technological options are appropriate and most likely to be successfully implemented in a given specific setting.

Whichever strategy is appropriate to the local circumstances and target population depends on a range of criteria, on which basis policy-makers, implementing organizations, and also the individual user can make their choice of technology. The target of this section is to outline a decision framework which describes a multitude of factors from different levels which can serve as a basis for an informed decision making on the choice of suited water treatment technology based on their psychological "profile".

While different types of treatment technologies have been compared in terms of their microbiological effectiveness (WHO, 2011), its potential to reduce the burden of diarrheal diseases (Fewtrell et al., 2005), and its technological aspects (compare e.g. Sobsey et al., 2008), this work focuses mainly on the psychological dimension of the user's perspective at the household level. Three types of common water treatment methods will be discussed within this section; these are chlorination, solar water disinfection, and filtration. These three technologies will be discussed along the factors outlined in the RANAS model (Mosler, 2012).

In how far the application and continued usage of these treatment options differ in terms of their psychological demands on the user's side shall be discussed in the following. This chapter therefore serves two purposes. It provides an overview of possible factors to consider when choosing between different water treatment technologies and gives an outlook of what could be continued based on this work in future research directions. In the specific project described within this thesis, the decision to opt for chlorine as the water treatment technology to be promoted within the implemented campaign was based on several reasons. First of all, among the surveyed population, chlorine was the most widely known for those who knew about

water treatment at all. Secondly, chlorine products are widely available on the local markets, so that no efforts to support the development of a supply chain was necessary. Further, chlorine is highly effective against the vibrio cholera, which was the major target pathogen in this project and is widely distributed during epidemics by other public health actors. However, as described above, other water treatment technologies are available with different advantages and disadvantages that could be discussed for the promotion in another setting.

Risk factors

An individual's estimation of the personal risk related to drinking untreated or treated drinking water should not show any differences between the technologies available to make water safe to drink. Rather, a certain level of risk awareness combined with health knowledge about the role of unsafe drinking water as a potential cause of diarrheal diseases is necessary to generate any motivation for health behavior change (Schwarzer, Lippke, & Ziegelmann, 2008), and risk awareness raising is a key component of many existing promotional activities in the WASH sector (Dreibelbis et al., 2013). Targeting personal risk awareness and providing basic knowledge on the importance of safe drinking water should potentially be considered in a campaign promoting any type of treatment technology.

However, personal risk evaluation and awareness of the consequences of diseases influenced individuals' water treatment behavior only in a minority of case studies reported in a review covering different safe water behaviors. Also health knowledge on the association between safe water behaviors and diarrheal diseases within the family did only positively influence subject's decision making to treat their drinking water in few cases, while it did not play a role in the majority of studied cases (Lilje & Mosler, 2017).

Attitude factors

On the individual subject's attitudinal level, several factors can influence not only the decision to start treating one's drinking water, but also which type of technology one will choose or see as appropriate. Commonly available technologies differ in a range of aspects such as perceived costs, value, and convenience as well as specific strengths and weaknesses of a product (compare to e.g. Dreibelbis et al., 2013; Sobsey et al., 2008). Combined with the individual level psychological attitudes and personal circumstances, these factors can certainly influence the choice of technology in use. In distinction to the inherent characteristics of the technology itself, it is therefore important to distinguish those from what the product looks like from the user's perspective of the user, that is the perceived features of a technology. This corresponds to the attitude factor block of the RANAS model comprising beliefs about costs and benefits, as well as a persons' feeling or emotions which are associated with thinking about or using the technology. Several attitudinal factors will be discussed in more detail below.

Monetary costs One such characteristic certainly is price. When talking about costs, one should discriminate between initial and running costs. On the first dimension, the acquisition of a filter is certainly more costly, if not subsidized by other means, than the initial costs for chlorine products or SODIS. While on the former dimension, if nothing unforeseen happens such as an early breakdown or damage, filters last for quite a while, while the other two options need replacement on a higher

frequency. Chlorination requires the repurchase of new product to refill the stock once used up, so there are moderate running costs. On another side stands the purchase or collection of a number SODIS bottles sufficient to treat enough water for the daily consumption by a shared user group such as a family. The estimated objective costs here are most likely very low, however certainly also depend on the availability of plastic bottles. In the long term, these will also need a replacement from time to time.

While the price of e.g. a filter or a bottle of chlorine has an absolute value that is comparable to any other good on the market, perceived price is another dimension. The perceived cost for any given option is closely linked to the household wealth from the individual level contextual factors and should be regarded as a function of available (financial) resources and absolute price as well as spending priorities of a household.

People who use SODIS seem to be the least off in terms of monetary wealth, so that for these price certainly plays a role. While the economic benefits of using SODIS are highlighted as a common reason for its application in the SODIS literature (McGuigan et al., 2012), perceived price did not contribute to explaining the intention to or the actual use of it in the majority of socio-psychological studies on this behavior (Altherr, Mosler, Tobias, & Butera, 2008; Graf, Meierhofer, Wegelin, & Mosler, 2008; Heri & Mosler, 2008; Kraemer & Mosler, 2010; Tamas, Meyer, & Mosler, 2013). However, in most of these cases bottle availability seems to be a major limiting factor for the amount of SODIS water that can be treated by one family and thus contradicts the general opinion that it is per se a "low-cost" technology.

On the other hand, if SODIS can replace fuel that had been needed for boiling, it can comparably reduce the costs for drinking water disinfection. So, when thinking about the promotion of certain treatment methods, one should always think about what the alternatives are that the population has or has been using instead (McGuigan et al., 2012). It is thus concluded that SODIS is a "gateway" technology that can eventually lead consumers to move on to higher-level technological HWTS solutions.

Depending on how the price for different technological options is perceived, intervention to promote the uptake of safe water technologies should assess these perceived costs. For the case of high initial costs it might make sense to contrast those against the running costs of other options in the long term. Also, costs for investing in personal health can be contrasted against the costs that (might) arise once a family member has fallen sick and needs medical treatment, which could have been avoided if safe water had been consumed exclusively. Perceived costs of water have been successfully addressed in a study on fluoride-free water consumption in rural Ethiopia (Huber, Tobias, & Mosler, 2014).

Time costs Apart from monetary costs, there are other types of expenditures that should be taken into account when talking about water treatment technologies that need some effort by the user. One such dimension is time. All three water treatment options under consideration here need a certain amount of time to be invested before water is safe for consumption. Chlorination is quickly done by adding the required amount of solution into the water body. It should then be slightly stirred and left for 30 minutes before the water is microbiologically safe. The amount of water that can be treated in a certain time merely depends on the volume of the storage containers available at a time.

Depending on the type of filter, it might take shorter or longer for the water to pass through, before it is available for consumption depending on the flow rate per

time. Also it makes a difference whether the water passes through the filter by itself (gravity driven) or needs some energy put in by its user (pumping or sucking the water through (e.g. personal Lifestraw filters).

SODIS certainly needs the longest amount of time before the water is ready to be consumed. The bottles should be left in the sun for at least six hours, possibly a lot longer when the weather conditions aren't perfectly sunny (McGuigan et al., 2012). In addition, when the bottles are taken out of the sun afterwards, the water is usually warm or hot and needs to cool down. Apparently, in most countries, the taste of cool water is preferred over warm or even hot water (apart from hot drinks like tea or coffee), so this fact certainly extends the time costs of SODIS compared to other technologies. This means that apart from filling the bottles, putting them out in the sun, and collecting them in the evening, the longest time is passive waiting time until the water is ready for consumption.

Benefits The "value" of treating water corresponds to perceived benefits as depicted in the RANAS model. This refers to in how far improvements are expected by the user such as increased health protection, possible improvements in taste, etc. as a result from water treatment. Expected health benefits are closely linked to "perceived threat" as discussed under the risk factors. Only when health threats are perceived as relevant, one would expect improvements from engaging in health behaviors. Social benefits can be expected where corresponding social norms exist. For example people could be proud to display and serve treated water to e.g. visitors or superiors in one's home by adopting a treatment technology. This could easily be done by displaying one's filter in the home, possibly by highlighting the smell of chlorine, but less so with SODIS bottles, unless it is evident that the water has been purified by the sun. In how far perceived benefits differ between the discussed water treatment technologies mainly depends on individuals perceptions of the effectiveness of the respective method – which does not necessarily correspond to the microbiological effectiveness. It is also depended on what other "effects" treating the water designated for consumption has on its characteristics such as taste or involved emotions.

Taste Another technology factor with an influence on individual's user preferences is taste of the treated water. Positive perceived taste of treated water has been identified as a very important factor enhancing the consumption of filtered water, SODIS water, and boiled water in a number of studies (Altherr et al., 2008; Heri & Mosler, 2008; Huber, Bhend, & Mosler, 2011; Tamas, Meyer, & Mosler, 2013). Most certainly, chlorination has the strongest impact on taste and depends on the user's taste preferences. Whether the taste of chlorinated water is acceptable (or a what levels) or how it is perceived in comparison to raw water depends on personal preferences and cultural habits. In many developed countries, people have adapted to the smell and taste of low levels of chlorine in their tap water, where it can be seen as a sign of the quality of this water (Flanagan, Meng, & Zheng, 2013). People used to the presence of chlorine thus can even be irritated or feeling insecure by its absence. On the other hand, people who are not used to chlorinated drinking water might have difficulties accepting the altered taste (Crider et al., 2017).

However, filtration can also have an impact on water taste as it removes the majority of biological and some chemical substances, thus alters the composition of the water. SODIS does not alter the characteristics of the treated water itself, but

temperature seems to play a strong role in the taste preference of users as discussed above.

Instrumental beliefs including the perception of "value" or effectiveness, as well as considerations around different types of costs and benefits had an influence on individuals' decision making to adopt water treatment options in over half of all studied cases reported in the psychological review on safe water behavior (Lilje & Mosler, 2017). Affective beliefs such as involved emotions and liking of the taste of treated water for example positively influenced individuals to choose to treat their drinking water in over two thirds of all studied cases. This underlines the importance of attitudinal factors in the promotion and adoption of safe water treatment technologies, but it also displays existing variability, which means that these factors have to be assessed for their influence each time a new treatment technology or behavior is to be introduced.

Norm factors

On the community level, the societal structure most certainly plays a role in the collective adaption of household water treatment technologies. Sanctions for people not behaving in the way they should or how the majority expects them to behave can play a role in individual decision making toward WASH behaviors (Devine, 2010). These can be explicit (e.g. in the form of fines to be paid) but also implicit with social ostracism for example for people behaving in the disapproved way. Community cohesion can influence individuals' decision making processes by the way information is being communicated.

Descriptive norm The descriptive norm, the perception of other people's behavior, is an important factor for the adoption of new behaviors in general (Bandura, 1991; Cialdini & Trost, 1998) and most often has an influence on individuals' safe water behaviors (Lilje & Mosler, 2017).

SODIS bottles have to be placed somewhere outside (e.g. the on the roof of the house) to be exposed to the sunlight for an extended period of time, at least several hours. This means that this behavior is highly visible to outsiders passing by (unless bottles are purposely hidden or placed somewhere inside the compound). In that sense, the usage of SODIS is a publicly visible behavior, merely demonstrating to the outside world that it is in use by the individual household. Observability is one of the key factors for the adoption of new technologies in the Diffusion of Innovation theory, one of the oldest social science theories (Rogers, 2010).

Social norms were found to be significant predictors of SODIS usage in several case studies. Social influence was highly predictive in another study in Zimbabwe where it ranged among the three most important factors discriminating between current users and non-users (Kraemer & Mosler, 2010). It was not predictive in one sample, but its role was discussed as potentially influential in another sample, although both samples were from Bolivia (Lilje & Mosler, 2017). Intention to use SODIS was predicted by others' usage, but did however not predict whether somebody actually used it or not in Nicaragua (Altherr et al., 2008).

The installation of filters and addition of chlorine to stored drinking water usually happens somewhere inside the house or compound. Storage containers are usually placed in the shade (under the roof) to stay cool and especially costly products like a filter are most likely to be kept where they cannot be stolen. This means that

in comparison to SODIS, these two options are rather private behaviors. The communication that one household is using these more or less exclusively depends on whether people talk about it to others or not. Whether water treatment is a topic of public discourse very much depends on the characteristics and existing norms within one community.

Injunctive norm This is also true for the injunctive norm reflecting other people's approval or disapproval of a behavior, e.g. in how far treating water with one or the other technology (or treating water at all) is seen as something positive or aspirational or not within a community. The perception of what other people think of one's own behavior is a very influential factor in human social psychology (Cialdini & Trost, 1998; Fishbein & Ajzen, 2010).

As some water treatment options are more visible than others (e.g. the usage of community level filters or chlorine dispensers) these might also be more easily subject of public discussion than the more private behaviors. This can also influence the extent to which these behaviors underlie social pressure in the form of injunctive norms. If for example certain authorities disapprove the usage of a technology (for whatever reasons they might have) it is easier for an individual household to treat water inside their house than outside or at a public place. This also holds true the other way around. If the usage of a certain technology is highly approved by influential persons within a community, then "public" behaviors are more likely to be picked up as people tend to orient themselves on people they respect.

Other people's behavior showed to be one of the most prominent factors which was important for individuals' decision making to opt for a safe drinking water option in a multi-country review on different safe water behaviors (Lilje & Mosler, 2017). This factor of the RANAS normative component was important in a majority of included case studied. On the other hand, injunctive norm, only played a role in around one third of cases.

Roles and responsibilities On the interpersonal level within the household, roles and responsibilities, and the division of tasks between household members might influence how different water treatment options are perceived and whether they are used or not. In an example from a field study in Nepal, Rainey and Harding (2005) describe how it is the role of the women to fetch and prepare the drinking water although they are just as "responsible for the cooking, dish washing, clothes washing, and childcare as well as the most of the cultivation and processing of agricultural crops" (Rainey and Harding, 2005, p. 367). Even though women often know best about water availability and quality, their huge daily workload often impeded them from participation in drinking water projects (Regmi & Fawcett, 1999). The workload of women might thus be a limiting factors to labor and time intensive treatment methods such as SODIS. On the other hand, when it comes to spending money on investments for the household WASH situation, it is oftentimes the men in the role as head of household who have the decision power where and if resources are allocated (Wakeman, 1995; Wijk-Sijbesma, 1998). Considering gender and power distribution within the household can be an important aspect when it comes to decision making around water treatment (Figueroa & Kincaid, 2007). Also the role of social support has been identified as an important factor for the use and promotion of water treatment technologies (Figueroa & Kincaid, 2007; Lilje, Kessely, & Mosler, 2015). This means that depending upon whose role within a household it is to organize water treatment, it is important to address these people in a promotion campaign. This is

also the reason why not only women as the primary caregivers of children are mostly responsible for the household chores and preparation of food, but also men in their role as providers of money (purchase of chlorine) and responsible for technical aspects (chlorination of drinking water) were involved in the presented campaign.

Personal norm Lastly, personal norm, the importance an individual assigns to health behaviors influences the choice for or against water treatment. However, personal norms should be of equal importance for any type of safe water options. Personal importance was less influential for subject's decision making and played a role only in some cases (Lilje & Mosler, 2017). The personal norm is closely related to an individual's commitment which describes how much a person is willing to invest into a targeted behavior (Gollwitzer, 1993).

Ability factors

How-to-do knowledge and confidence in one's own abilities are very important factor in the health psychological literature which have a mediating effect at all stages of behavioral action from the building up of an intention to the behavioral execution (beginning of new health behaviors, continuation of such, and recovering from drawbacks) (Fishbein & Ajzen, 2010; Norman, Boer, & Seydel, 2005; Schwarzer, Lippke, & Ziegelmann, 2008). Perceived behavioral control is closely linked to an individual's perceived ease or difficulty of performing necessary behavioral steps towards more healthy behavior. Among others, self-efficacy convictions have been identified as one of the most important psychological factors for different water treatment behaviors in a multi-country review study on different safe water behaviors (Lilje & Mosler, 2017).

Action knowledge/difficulty In terms of knowledge about how to perform water treatment, there might be slight differences between the different safe technologies under review here. While SODIS and filtration seem to be very easy to perform for the user, chlorination needs some knowledge about how to calculate the correct dosage that needs to be applied to a given quantity of water. However, when it comes to cleaning a filter or replacing broken parts, the long-term usage and maintenance of a filter unit might be a little more complicated. The perceived difficulty of carrying out water treatment using the different technological options can have an influence on the perceived self-efficacy, that is the level of confidence into ones' own abilities to carry out and continue to carry out water treatment, as well as to recover from arising difficulties.

SODIS bottles as well as filters will need some cleaning and/or replacement of bottles or broken/clogged parts from time to time thus potentially challenging the user's confidence in continuation and recovery. Contrasting to the slightly more complicated procedure using chlorine, chlorination does not need any long-term maintenance behavior from the user unless it is the cleaning of the storage container from time to time when it is strongly polluted. This affects the other two options as well if water is stored for longer periods of time within the household. In terms of the confidence in recovering from drawbacks, chlorination is more dependent on the consistent supply of the material from the market (discussed below). However, if spare parts or new bottles are needed their user's confidence also depends on the availability of these materials.

Access to markets and products The access to a product on the national or regional level influences the ease of getting to resources and securing the necessary supply. This is in relation to the supply chain aspect discussed by Sobsey et al. (2008). While the supply with plastic bottle for SODIS is generally seen as unproblematic due to their almost ubiquitous presence in today's days, the market availability of more complex products such as chlorine products or specialized filters might be more restrictive.

Whether people have access to products not only depends on the availability of the products, but also their possibility to visit these markets and to buy the product. This is especially important for chlorination as this technology demands a more or less constant repurchase of new disinfection material. Especially in rural setting it can be burdensome and economically effortful for families to visit the next market place where the product is available. While SODIS bottles might have to be replaced after a certain time, chlorine has to be constantly provided and repurchased once it is used up. Filters usually last longer, but when it comes to damage in filters, parts for exchange or renewal of the new filter might be problematic, especially when these were promoted and handed out during a one time intervention without guaranteeing constant supply.

Availability of SODIS bottles seems to be a limiting factors for the amount of SODIS water consumed by families in different study settings (Altherr et al., 2008; Heri & Mosler, 2008; Tamas, Meyer, & Mosler, 2013). The role of availability of SODIS bottles does not result in a comprehensive uniform picture. While availability per se did not predict the usage of SODIS, it did however, limit the amount of water treated using solar disinfection (Altherr et al., 2008). This also explains e.g. while only a portion of the consumed water is being treated but was not a significant reason not to use it. Another study finds that bottles for SODIS are quite a scarce resource in Bolivia, where the average availability was found to be between two and three bottles per household on average (Heri & Mosler, 2008). Availability was also predictive in the other Bolivian study, especially also the availability of alternatives such as firewood for boiling (Tamas, Meyer, & Mosler, 2013).

Self-regulation factors

Action planning In terms of planning and monitoring one's own actions needed to treat drinking water, SODIS seems to be the technology demanding the highest workload. Because the bottles need to be placed in the sunlight for several hours during the daytime, they need to be put outside with sufficient water quantities in the morning of the day. This means that depending on the daily tasks, forgetting to put out the bottles in the morning can mean that there will be no safe water ready to be consumed in the afternoon/evening or even until the end of the next day. Forgetting to do this once therefore has strong consequences and remembering to put the bottles into the sun is even more important. Thus the usage of SODIS has to be well integrated into the daily routines in order to be effectively and consistently carried out. SODIS bottles, whether empty or full within one's household or perhaps on the neighbors' house can serve as a reminding cue to prepare them.

There are quite a number of possible barriers that can interfere with the intention to use SODIS for drinking water disinfection. Bottles might have been misused or misplaced so they are no longer available when needed. Plastic bottles are also prone to degradation after a certain amount of time in use. There might not be enough sunlight during the day due to weather conditions or the season of the year, and

bottles can be stolen because they are placed outside and might not be in sight for the owner during the time they are placed on the roof or somewhere outside.

The usage of chlorine requires less planning as treatment can be done at any time during the day or night time, and the water is usually ready for consumption after around 30 minutes of waiting time. Forgetting to treat the water is thus not very worrisome as the action can be fulfilled also after noticing that treatment has not yet been effectuated. Further, while the taste of chlorine can have negative impacts on the taste preferences in some subjects as discussed earlier, taste can serve as a strong reminder for chlorination. Presence of chlorine in the water signals that the water has been treated and is therefore safe for consumption; its absence can serve as a cue to the consumer to remind him or her that the water still needs to be treated. In some countries, the taste of chlorine is seen as an indicator that the water which is being consumed is also safe to drink. Potential barriers to the usage of chlorine are when projects end which have subsidized or supplied chlorine and the material cannot easily be replaced or repurchased by its beneficiaries.

For the act of filtration, planning and monitoring is also fairly easy. Water can be treated at any time during the course of the day, and, depending on the flow rate, safe drinking water is available almost instantly after filling with raw water. Filters are usually quite bulky objects (unless it's a one person item which usually doesn't have the capacity to supply a whole household) which are placed somewhere within the household or compound. They can thus serve as strong reminders to fill them up with raw water and to only take water from there for consumption. Filters can clog after a certain time of usage when they are not routinely cleaned on their inside, and depending on the fabric, parts of the filter might break in which case they might not be easily replaceable.

Self-regulation factors have not been assessed consistently throughout the case studies represented in the multi-country review on safe drinking water behaviors (Lilje & Mosler, 2017). Where they have, they show a mixed picture of importance in terms of the interviewed subjects' behavior. However, one major difficulty of comparing users to non-users of safe drinking water options is that in order to answer questions about experienced difficulties and monitoring one's own behavior is that these questions can logically only be answered by people who show or have at least tried out the behavior. This is one reason why these factors have not consistently been analyzed in some studies (see e.g. Lilje, Kessely, and Mosler, 2015; Lilje and Mosler, 2016).

Habit On the habitual level, context can play a role favoring or hampering the formation of habits (Aarts, Verplanken, & Knippenberg, 1998; Orbell & Verplanken, 2010; Verplanken, 2006). Environmental circumstances can constitute opportunities or barriers for the routine application of water treatment technologies. If for example, the daily life is structured in a very repetitive way around the house, then integrating a behavior such as placing SODIS bottles out in the sun every morning might be easier than doing the same, when the daily tasks are different each day. If household members have to commute for working in the fields, even staying overnight away from their houses, such a behavioral integration might be more difficult. Chlorination of water is more flexible as the product is small and lightweight, can be carried along, and used for small quantities of water even, so that individual bottles of people working outside the house can be disinfected along the way. Meanwhile, a filter is more or less permanent within the household compound and may not be that easily displaced. Water thus can only be treated in place, so that

if drinking water is needed away from the house, this needs some more planning ahead and the formation of routine might not be that easy.

An important step towards the formation of habits lies in the role of memory aids (Tobias, 2009). As previously discussed the type of cue that the water treatment technology provides to its user can represent an opportunity for habit formation when it serves as a strong cue. SODIS bottles on the neighboring houses roofs, a filter which is placed centrally within the household, or the chlorine solution or tablets which are placed in a way that they are in frequent eyesight of the household members, can help to remind people of treating their water daily and thus serve to establish strong habits. Whether or not the application or usage of a treatment technology is easily routinized also depends on its usability features. While e.g. a filter that is placed within the home serves as a strong reminder to fill it with water on a regular basis, and take water from there when needed. The smell of chlorine in treated water or its absence can also serve as a cue to its potential consumers whether the water has already been treated or to remind them that this is still necessary before it can be consumed unhesitatingly. Whether or not the SODIS bottles outside one's house remind their inhabitants of its exclusive use for drinking probably depends on how visible these are upon seeking water or when coming home. But more importantly, the user has to remind him or herself to put the bottles outside in the first place. This is certainly not an inherent feature of the technology itself, but strong rituals would have to be developed so that bottles are always filled and placed in the sun when emptied or for example every morning when leaving the house.

Additional factors (context/important other factors/confounders)

Social support The concept of social support can be understood from several perspectives. While the term is often used to describe the strength of an available social network in general, two key components are distinguished in the literature, perceived and received social support (Schwarzer & Leppin, 1991). Whereas perceived social support is relatively independent from actual behaviors but rather refers to the level of support generally available (Sarason, Sarason, & Pierce, 1990), received social support captures the actual amount of transactions in a given relationship. The items assessing social support which were used in the questionnaires of the presented studies focused mainly on received social support. Received social support more closely represents what actually happens within one family (Scholz, Ochsner, Hornung, & Knoll, 2013). The extent to which social support interactions might help in the application and usage of one or another water treatment technology should be relatively independent on the type of technology used, but rather depend on the characteristics of the given relationships between involved persons or family members. Both, social support and social discourse were counted among the normative factor block within the presented studies.

Social discourse Social discourse was included into the presented studies as another variable in the social norm complex, depicting a measure of communication between people about a health topic. It is meant to capture the extent to which water treatment is a topic of discussion between family members and members of the community showed to be a very influential factor for drinking water chlorination for the prevention of cholera in a sample from Chad.

Wealth On the individual or household level, wealth certainly has an impact on whether and which technologies would be adapted. The available financial resources have an indirect effect on perceived price and therefore also self-efficacy convictions. Where the available income is limited or strongly differs between families in the same area some options might be preferred over others due to people's willingness to pay for it.

Education The individual's level of education certainly influences several of the psychological factors directly, such as risk perception and health knowledge, beliefs about costs and benefits, self-efficacy convictions, and self-regulation factors. People of higher education and cognitive capability are certainly more likely to know about scientific disease theory and would therefore be able to assess their own levels of risk for disease prone to their environmental circumstances. If the weighing up of costs and benefits from the introduction of a water treatment technology into the household is not easily apparent, people with higher education might find it easier to understand and estimate future benefits, especially when those are only to be expected in the long run (e.g. avoiding of negative consequences of fluorosis or arsenicosis which only become apparent after years of consuming contaminated drinking water). Lastly, people who have received a higher number of years in formal education might also be better in generating action plans and applying self-monitoring strategies to ascertain the continuous use and application of technological solutions. While wealth and education certainly correlate to a high degree in many societies, wise decision making certainly does not only depend on formally experienced education.

Resume

The presented framework is meant to inform and support the decision making process into choosing appropriate water treatment technologies within a given program or setting by considering their psychological profiles and match with the existing mindset of the target population. It can also serve as a "checklist" for practitioners in the field of the development context working on behavior change programs to evaluate their own approaches in behavior change programs and to extent existing campaign designs by adding previously unconsidered factors. This list can potentially help the different stakeholders involved in HWTSs programs to develop campaigns effectively and efficiently by supplying them with an underlying matrix of factors to consider in the planning phase of a promotion campaign and the choice of technologies to promote.

1.6 Methods

This section describes the overall timeline and methodology of the research undertaken during the course of this project. First an overview of the included empirical studies is provided.

1.6.1 Description of studies included and research questions

Three studies presented within this thesis document the research process around a health campaign project promoting drinking water chlorination in several communities in the Lake Chad basin in central Africa. This research was embedded in a

larger project funded and coordinated by the World Health Organization (WHO) in Geneva together with their country office in Chad and the Ministry of Public Health in Chad. The project's aim was to develop and test strategies for the prevention of cholera cases in this high risk area along the Chari and Logone river system on the border between Chad and Cameroon.

Study one served as a baseline reference on which basis intervention strategies were then developed for the targeted campaign. Relevant behavioral factors for the uptake and usage of drinking water chlorination were identified and behavior change strategies proposed for the promotion of drinking water treatment. It also serves as a reference for evaluation of the campaign effects. The following research questions are addressed:

1. What is the current situation concerning water treatment behavior in households and are there important environmental or technological factors influencing water treatment behavior in Chad?

2. What are the psychological determinants for the promotion of water treatment at the household level and how should they be addressed in interventions?

3. Can subgroups of people or disadvantaged groups be identified on the basis of differences in environmental, technological, socioeconomic, and psychological factors?

Study two examines how behavioral factors evolve over time between different user groups without interference of any interventions. It identifies behavioral factors for sustained drinking water chlorination in a longitudinal sample and describes which factors play a role in the continuation of treatment behavior. It addresses the following research questions:

1. Which psychological factors show differences between subjects continuing and those stopping water treatment?

2. Which psychological factors change over time when people continue or stop water treatment?

3. Which psychological factors change differently over time between the two groups?

Study three set out to evaluate the effects of a promotion campaign for drinking water treatment that was developed based on the findings from study one. Participants of the interventions are followed up to identify any changes in behavior and to test which of the factors targeted by the interventions changed and how these mediated change in water treatment behavior by participants compared to non-participants. Research questions addressed in this study are:

1. Did the campaign have a positive impact on water treatment among intervention participants?

2. Did the campaign affect psychological factors for drinking water treatment that were targeted by the campaign?

3. Which of these psychological factors mediated the effects of the campaign on behavior?

1.6.2 Sample & Procedure

The samples for the three studies were drawn from ten different communities in the targeted region along the border between Cameroon and Chad which had been recommended by the Ministry of Public Health based on the cholera prevalence in the years preceding to the project. The area is known to be regularly affected by cholera epidemics and lies within three districts which were most heavily affected by the latest outbreaks. For a an overview on the study region and locations of the communities, refer to Figure 1.1.

Households were selected randomly based on a random-route procedure according to Hoffmeyer-Zlotnik (2003). Selected communities were divided up into equal parts. Subsequently interviewers were dropped off at different edges of the community from which they started to sample every third household along the way. The targeted person within available households was the primary caregiver of a child younger than five years of age, which were mostly women (>90%). Refusal rate to participate in the surveys was less than 10%.

To identify critical psychological factors for behavior change, structured household interviews were administered to a total of 1017 primary caregivers of children under the age of five years at baseline in two distinct surveys (sample 1 in Figure 1.5), assessing their thoughts and attitudes toward household water treatment according to the RANAS model. The intervention potential for each factor was estimated by analyzing differences in behavior and mindsets between households currently performing water treatment and those who were not doing so.

FIGURE 1.4: Personally assisted interview situation; the questionnaire is administered face-to-face to a respondent
(Picture by Jonathan Lilje)

Sample 2 consists of 197 households (Figure 1.5) which were followed up upon from the first sample, which had reported treating their drinking water at that time. The results are based on the comparison between data from the baseline study and data from the follow-up survey. By contrasting the mindsets of caregivers who continuously performed household drinking water treatment over time with individuals that stopped doing so relevant factors for behavioral continuation were identified. All previous factors from health psychology based on the RANAS model were used to monitor changes in the two groups and examine their different development over the course of time.

For the impact evaluation of the implemented campaign, 220 primary caregivers

in intervention communities (sample 3, Figure 1.5) were interviewed regarding current household water treatment practices and their mindset related to water treatment using the RANAS model six months after the intervention ended. Water treatment rates and psychological factors were compared between participants and non-participants of the intervention. The role of psychological factors in the process of behavior change was explored using mediation analysis. This sample does not match with the previous samples.

A detailed view on the different samples, studies and the timeline of the project can be found in Figure 1.5. The baseline sample represented in study 1 was collected during two surveys separated by about half a year, the first half during December 2013 and the second half during May 2014. The follow-up sample for study 2 was collected in October 2015. The sample for the evaluation study 3 was collected in July 2016, after interventions had taken place between November 2015 and January 2016. A time horizon of the project, sample sizes, and the allocation of samples to the different studies can be found in Figure 1.5.

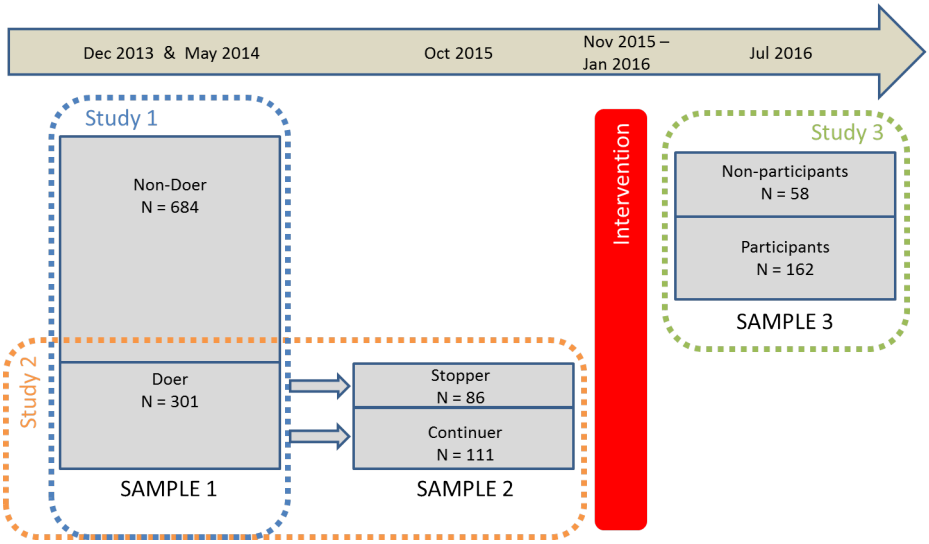

FIGURE 1.5: Overview of samples and studies

1.6.3 Measures

Water treatment behavior

Current water treatment behavior was judged based on the self-report by the interview partners within each household and further confirmed by assessing knowledge around water treatment and the presence of water treatment devices or products within the household using spot-check measures. Residual chlorine testing was only used on a sample basis during survey 3. Results are not presented in the three studies due to difficulties, but will be discussed in the discussion section.

Psychological factors

Questionnaire items measuring psychological factors were constructed on the basis of the RANAS (Mosler, 2012). Each factor from all factor blocks is represented by at least one questionnaire item to cover all dimensions of the behavioral determinants. Interviewers were trained in using electronic based versions of the questionnaire on tablet devices in personally assisted face-to-face interview situation with their

respondents (Figure 1.4. The original survey tool was designed in French, revised with in-country partners and translated into the locally spoken languages during the course of the training with all interviewers to assure common understanding of all concepts.

Exemplary items from the original questionnaire can be found in Table 1.1. The same survey tools were used during all three studies, except for the addition of questions to assess participation in and recall of intervention materials. The full questionnaire can be found in the Appendix C.

TABLE 1.1: Exemplary item from the questionnaire, answer formats, number of items used, and scale reliability

Factor block	Factor	example item from original questionnaire	answer format	N items	Reliability
RISK	Vulnerability	Generally, how high do you feel is the risk that you get diarrhea?	very low - very high	5	.925
	Severity	How severe do you rate the impact on the health of your child below 5 years when it has diarrhea?	not at all severe - very severe	2	.894
	Health knowledge	Can you name the major causes for getting diarrhea ?	open questions; rating	11	sum score
ATTITUDES	Feelings	How much do you like or dislike the taste of treated drinking water?	very much dislike it - very much like it	1	—
	Beliefs about costs and benefits	How time-consuming is it for you to treat your drinking water?	not at all time-consuming - very time consuming	2	.512
		How expensive is it for you to treat your drinking water?	very expensive - not at all expensive	1	—
		How certain are you that treating your drinking water can prevent you and your family from getting diarrhea?	not at all certain - very certain	5	.824
NORMS	Others' behavior	How many of your greater familiy and friends treat their drinking water?	(almost) nobody - (almost) everybody	2	.779
	Others' (dis)approval	People who are important in the community (e.g. Imam, Chief of village, etc.) how much do they promote that you should treat your drinking water?	not at all - very much	1	—
	Personal importance	Do you feel a personal obligation to treat your drinking water?	not at all - very much	2	.432
	Social Support	How strong does the head of your household support your family in treating your drinking water?	not at all - very much	1	—
	Social Discours	How often do you talk about water treatment with other people?	never - (almost) every day	1	—
ABILITY	How-to-do knowledge	After chlorination, you have to wait at least 30 min until the water is safe to drink.	closed questions; yes/no	8	sum score
	Confidence in performance	How certain are you that you will always be able to treat your drinking water before drinking?	not at all certain - very certain	5	.846
	Confidence in continuation	How confident are you that you will be able to treat your drinking water even if you do not feel like doing so in the moment?	not at all confident - very confident	5	.846
	Confidence in recovering	How confident are you that you will be able to continue to treat your drinking water even when you have forgotten to do this for a while?	not at all confident - very confident	5	.846
SELF-REGULATION	Action planning	Do you have any plans how to make sure that you can always treat your drinking water?	open questions; rating	1	—
	Action Control	How strongly did you try to remember treating your drinking water at all times during the last week?	not at all - very strongly	3	.791
	Barrier planning	Do you have a specific plan how to deal with difficulties?	open questions; rating	1	—
	Commitment	How much do you feel commited to treating your drinking water?	not at all - very much commited	3	.532
	Habit	How much do you treat your drinking water rather automatically without having to think about it a lot?	not at all - very automatically	3	.887
	Intention	How strongly do you intend to always treat your drinking water?	no intention - very strong intention	1	—
	Behavior	Do you currently do anything to make your water safe to drink?	yes/no	1	—

1.6.4 Interventions

The intervention campaign which was implemented in the course of the presented project was developed based on findings of the baseline study (surveys 1 and 2). Results were presented to and discussed between all project stakeholders before developing an intervention protocol and materials.

Volunteer health care workers from the local health care centers in each of the communities were trained to roll out the interventions in their respective home communities in collaboration with the local health care centers. The campaign was implemented in two phases. In a first round only half of the ten target communities received the intervention program while the other half stayed as a waiting control group to test effects against. In a second round, the control group communities received the same interventions.

Description of the campaign

Interventions were delivered in the form of community meetings. These meetings were organized by the local health care centers in each study community. The sessions were led by a pair of promoters trained at a two-day workshop prior to the intervention. The intervention roll-out was supervised by the principal of the health care facility. Regular monitoring visits were made by the partnering NGO, Centre de Support en Santé Internationale (CSSI), who had also organized the training. During the first sessions, promoters were assisted, and feedback was given on their performance after the session. Later, the visits served to monitor correct implementation, usage of materials, and collection of participant lists.

In each community, a total of eight to twelve one-hour sessions were held during the period from November to December 2015. Meetings were organized in public buildings such as schools or town halls, and contents were repeated so that each session delivered the complete information and materials. The intervention design and manuals for promoters were conceptualized by Eawag, in collaboration with CSSI, the WHO country office, and the Ministry of Public Health in Chad. Detailed information on the intervention manual can be found in the Appendix A (in French).

Intervention sessions were organized around four elements implementing several behavior change techniques (BCTs) (Abraham & Michie, 2008; Michie et al., 2008; Mosler & Contzen, 2016); these were chosen based on the findings of the baseline survey. All four elements were presented to the participants during each intervention session in the order presented below. An overview of the different elements used, behavior change techniques applied, and factors targeted can be found in Table 1.2.

TABLE 1.2: Intervention elements, Behavior Change Techniques, and targeted factors

Element	Behavior Change Techniques	Targeted factor(s)
Spot	BCT 3: Inform about personal risk	perceived vulnerability
	BCT 5: Inform about and assess costs and benefits	perceived costs and benefits
	BCT 15: Provide instruction	how-to-do-knowledge
	BCT 9: Inform about others' behavior	others' behavior
	BCT 11: Inform about others' (dis)approval	other's approval
Poster	BCT 1: Present facts	health knowledge
	BCT 7: Prompt to talk to others	perceived costs and benefits
Practical demonstration	BCT 15: Provide instruction	how-to-do-knowledge
	BCT 17: Demonstrate and model behavior	confidence in performance
Public commitment	BCT 10: Prompt public commitment	others' behavior
	BCT 21: Organize social support	confidence in performance
	BCT 34: Use memory aids and environmental prompts	remembering

Audio spot The first element was a pre-recorded audio advert which introduced several arguments and personal statements about water treatment. These statements were inspired by interview responses given during the baseline surveys. The script was then refined to cover various aspects of water disinfection, such as how-to-do knowledge, vulnerability, perceived costs and benefits, abilities, and social norms concerning water treatment. Several BCTs were incorporated in this recording, such as "Inform about personal risk" (BCT 3), "Inform about and assess costs and benefits" (BCT 5), "Provide instruction" (BCT 15) targeting risk, attitude, norm, and ability factors. The statements in the recording were mixed so that positive stances outweighed negative stances. This fed the impression that more people were engaged in the behavior than those who were not and served as a means to target the perception of others' behavior and others' approval ("Inform about others' behavior", BCT 9; "Inform about others' approval/disapproval", BCT 11). Below is an exemplary statement played during the audio recording targeting perceived costs and benefits (BCT 5, translated from French; the full set of statements can be found in the Appendix B).

> *"I went to buy « eau de javel » (liquid chlorine solution) at the local market, the price is about the same as for a pack of salt or sugar and it serves to treat the drinking water for our family for a whole month. Some people say it is too expensive or that they don't have the money for that. But if you think about the costs to buy medication each time when your kids fall sick, it is actually not that much money"*

The recording was provided to promoters as an MP3 file on a memory card together with a playback device and batteries. It was played to participants at the beginning of the intervention sessions (Figure 1.6). The advert was conceived in collaboration with a local radio station, spoken by professional actors, and recorded in three different languages, French, Arabic, and Sara.

FIGURE 1.6: Participants listening to the pre-recorded audio spot. (Picture by Jonathan Lilje)

Informational poster The second element was a poster communicating information on where and how diarrhea is contracted and what can be done to prevent it (Figure 1.7). It was an adaptation of the F–diagram (Cluster, 2011), which graphically depicts several pathways of diarrhea propagation and how those pathways can be interrupted. The poster used BCT 1 ("Present facts"), targeting health knowledge and explaining to participants where and why they are at risk. The main target

behavior of the campaign, drinking water disinfection, was introduced as a means of protecting oneself and one's family from diarrheal disease including cholera on the poster. Participants were encouraged to discuss the contents of the poster among them to spark social discourse on the topic (BCT 7: "Prompt to talk to others").

FIGURE 1.7: Participants discussing the contents of the information poster together with the promoter. (Picture by Jonathan Lilje) For the full size poster, please refer to Appendix A.

Practical demonstration The third element was a practical demonstration mainly targeting how-to-do knowledge ("Provide instruction", BCT 15) and confidence in performance ("Demonstrate and model behavior", BCT 17). Promoters demonstrated to participants how to correctly apply chlorine products for drinking water disinfection, including how to calculate the dosage needed (Figure 1.8). Other practical aspects were also discussed, such as where to buy chlorine, how to store and use the products safely, and what kind of locally available containers could be used for measuring quantities.

FIGURE 1.8: Promoter explaining correct dosage and application of chlorine to intervention participants (Picture by Jonathan Lilje)

Public commitment The fourth element, which concluded each session, was a public commitment appeal (BCT 10: "Prompt public commitment"). Participants were encouraged to make a public pledge in front of the assembled audience to treat their household's drinking water after having learnt the practical skills necessary. Heads of households were prompted to supply material and funds to the person responsible for the provision of drinking water within the household. Caregivers who were not heads of households were prompted to seek support from their heads of

household (BCT 21: "Organize social support"). Participants committing to treating their household's drinking water received a commitment sign (Figure 1.9). This was a piece of blue cloth to be displayed on the participant's house. The sign had two main functions. One was to publicly communicate their engagement to their neighbors, visitors, and passers-by, thus highlighting the descriptive norm. The second function of the sign was to remind the members of the household about their commitment (BCT 34: "Use memory aids and environmental prompts").

FIGURE 1.9: Participants receiving commitment signs to be put up at their houses (Picture by Jonathan Lilje)

Chapter 2

Factors Determining Water Treatment Behavior for the Prevention of Cholera in Chad

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Abstract

Cholera is a well-known and feared disease in developing countries, and is linked to high rates of morbidity and mortality. Contaminated drinking water and the lack of sufficient treatment are two of the key causes of high transmission rates. This article presents a representative health survey performed in Chad to inform future intervention strategies in the prevention and control of cholera. To identify critical psychological factors for behavior change, structured household interviews were administered to $N = 1,017$ primary caregivers, assessing their thoughts and attitudes toward household water treatment according to the Risk, Attitude, Norm, Ability, and Self-regulation model. The intervention potential for each factor was estimated by analyzing differences in means between groups of current performers and non-performers of water treatment. Personal risk evaluation for diarrheal diseases and particularly for cholera was very low among the study population. Likewise, the perception of social norms was found to be rather unfavorable for water treatment behaviors. In addition, self-reported ability estimates (self-efficacy) revealed some potential for intervention. A mass radio campaign is proposed, using information and normative behavior change techniques, in combination with community meetings focused on targeting abilities and personal commitment to water treatment.

2.1 Introduction

Diarrheal diseases are the second largest threat to children in developing countries, causing an estimated 700,000 deaths in children under the age of 5 years in 2011, and are a leading cause of deaths worldwide (Walker et al., 2013). Globally, cholera is on the rise, with an estimated 3–5 million cholera cases and 100,000–120,000 deaths reported each year, and a potential 1.4 billion people living at risk in endemic countries (WHO, 2012). The increase in cholera cases can be directly

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linked to the ever-increasing number of vulnerable people living in unsanitary conditions without access to safe drinking water and adequate sanitation and hygiene. According to data from 145 low- and middle-income settings, the highest risk for diarrheal diseases within the cluster of risk factors results from inadequate drinking water (Prüss-Ustün et al., 2014). Evidence on the positive effect of point-of-use treatment on water quality, and significant reductions in diarrheal diseases among its users, exists (Akoachere, Omam, & Massalla, 2013; Arnold & Colford, 2007; Cairncross, 2009; Clasen, Schmidt, Rabie, Roberts, & Cairncross, 2007; Reller et al., 2003; Quick, Venczel, et al., 1999; Quick, Kimura, et al., 2002; Sasaki et al., 2008). The usage of chlorine products has been described as one effective and easy-to-use means of water disinfection. Likewise, the protective effect of solar-disinfected water against cholera infections in small children has been shown and could serve as an alternative point-of-use treatment method (Conroy, Meegan, Joyce, McGuigan, & Barnes, 2001). These products are relatively inexpensive and usually locally producible (Sobsey, 2011). Compared with other key hygiene domains, water treatment interventions have been found to be the most effective for the prevention of diarrheal diseases, and combinations with different intervention elements did not augment these effects (Luby, Agboatwalla, et al., 2006; Fewtrell et al., 2005). Treatment at point of use is also seen as superior to treatment at other levels (e.g., the source) due to possible recontamination during the transport, storage, and consumption process (Mintz, Reiff, & Tauxe, 1995; Rufener, Mausezahl, Mosler, & Weingartner, 2010). Water quality interventions at point of use are thus considered elementary wherever access to safe water is not provided 24 hours a day (Fewtrell et al., 2005). The role of unsafe water as a risk factor and the effectiveness of water treatment have also been shown in the context of cholera epidemics (Nguyen et al., 2014; Hutin, Luby, & Paquet, 2003). In their spatial analysis of risk factors, Sasaki and others 2008 describe the risk for infection with cholera as a result of individual hygiene behaviors in addition to environmental circumstances. In this sense, the application and continued usage of point-of-use water treatment technologies directly rely on the end user's behavior, wherever necessary infrastructural or environmental factors are given. The success of intervention campaigns therefore depends substantially on individual behavior changes. Substantial change in human behavior is always mediated through shifts in psychosocial factors that determine an individual's behavior, such as attitudes, normative beliefs, and perceived self-efficacy, regarding a specific behavior (Albarracin et al., 2005; Mosler, Blöchliger, & Inauen, 2010; Mosler, 2012; Huber & Mosler, 2012; Tamas & Mosler, 2011). To our knowledge, no structured assessment of psychological determinants for water treatment via chlorination has been conducted to identify crucial factors to address in the design of behavior change interventions, and we could not find any publications on similar approaches for the targeted region. For the first time, a structured and representative survey on behavioral determinants for water treatment behavior was therefore applied to a region at high risk for cholera in Chad. Tailored intervention strategies for the promotion of these key drinking water, sanitation, and hygiene (WASH) behaviors can subsequently be designed based on these findings, addressing exactly those psychological factors that have been shown to be of high importance for the adoption and maintenance of water treatment behavior within a specific local population. The RANAS (Risk, Attitude, Norms, Ability, and Selfregulation) (Mosler, 2012) model has been especially developed for the prediction of health behaviors in developing countries and is based on several established psychological health-behavior theories (e.g., health belief model (Rosenstock, 1974), protection motivation theory (Floyd, Prentice-Dunn, & Rogers, 2000), theory of planned behavior (Fishbein & Ajzen, 2010), and health action process approach

(Schwarzer, 2008; Schwarzer, Sniehotta, et al., 2003). The model depicts five distinct components or "factor blocks" (Mosler, 2012) that should be considered for a comprehensive understanding of the psychological characteristics of a study population in determining a specific behavior.

Risk component: The risk factors address the individual's understanding and awareness of his or her personal vulnerability to, and the severity of, a disease.

Attitude component: Attitudinal factors address an individual's feelings, as well as convictions about costs and benefits of a specific behavior, such as perceived price, taste preferences in the case of chlorinated versus non-chlorinated water, and expectations about beneficial consequences of a behavior.

Norm component: Norm factors represent the perception of how common a behavior is experienced within the social network, how popular or unpopular it is considered to be seen, and the level of personal obligation to conform with it.

Ability component: Ability factors capture individuals' estimation of their own competence in executing a behavior, including its uptake, maintenance, and recovery from drawbacks.

Self-regulation component: Finally, self-regulation factors address the question of self-monitoring strategies for a continued use or application such as remembering and coping planning for dealing with existing barriers or arising difficulties that constitute hindrances from the execution of a specified behavior.

All five RANAS components with their respective individual factors have predictive quality for an individual's behavior and can therefore be used in the assessment of intervention potential (IP) for behavior changes concerning point-of-use water treatment.

Once the assessment of the current psychological state of a study population regarding key hygienic behaviors has been done, the RANAS model also depicts which type of behavior change technique (BCT) should subsequently be applied (Mosler, Huber, Inauen, & Tobias, 2013). The application of this approach can thus guide toward evidence-based decision making on strategies for the design of behavior change campaigns in the promotion of water treatment behaviors.

In addition to psychosocial factors on the individual level, the Integrated Behavioral Model for Water, Sanitation, and Hygiene (IBM-WASH) calls for the inclusion of contextual (or environmental) and technological factors that can also influence an individual's behavior, especially in settings that lack basic infrastructure (Dreibelbis et al., 2013). Therefore, technological characteristics and environmental specifications of study sites should be considered in the development of intervention strategies, for example, including information on water sources, prices, and access to treatment material or technologies.

The authors of "Recommendations from international consultants on WASH targets and indicators post-2015" demand that "disadvantaged groups must be identified" to meet the global target of reducing inequalities within populations concerning access to safe water and sanitation" (update 2014) (WBG, 2014). Those groups often represent the poorest of the poor (the bottom quintile), and special attention should be paid to serving them (Wisner, 2004). Potentially disadvantaged subgroups should therefore also be identified regarding access to technology, as well as other

(environmental) factors, prior to the design of interventions, to supply these groups with specially tailored or additional interventions aimed at reducing existing inequalities.

2.1.1 The present study

The present study is part of a larger program for the development of BCTs in the effort to sustainably prevent and control cholera, for adoption by governments and public health practitioners. Within this project, we plan to implement community-based cholera prevention activities, with a particular focus on behavior changes concerning household water treatment. The geographic focus is on communities in the Lake Chad Basin that have been repeatedly struck by cholera outbreaks within recent decades (MSP, 2013). According to the World Health Organization (WHO), in 2010 and 2011, the entire region witnessed dramatic episodes of cholera, reporting over 60,000 cases (WHO, 2012). This region features the typical environmental factors for a high risk of cholera outbreaks in river areas: hot air and low rivers that foster the breeding of bacteria, with subsequent inundations during the rainy season that enhance the probability of contact between humans and contaminated water and cause a breakdown of sanitary infrastructure (Jutla et al., 2013).

The country of Chad is located in central Africa, with an area of 1,284,000 km2 and a total population of 11,175,915. Accessibility to basic social services is hampered by illiteracy, poverty, sociocultural burdens, and the geographic environment. According to the national demographic and health survey from 2004, health indicators show that the main causes of consultations at health facilities are malaria, acute respiratory infections, diarrhea, dermatitis, and trauma. Rates of access to drinking water and sanitation on the national level were 51% and 11%, respectively, in 2012; however, these averages mask important differences across regions and the majority of the population (88%) do not have improved latrines (Ouagadjio et al., 2004; INSEED, 2012). These precarious conditions are related to access to safe drinking water, sanitation, and hygiene, and are important risk factors for high rates of morbidity and mortality.

The present survey's goal was to assess psychological determinants for point-of-use water treatment in the local populations of several communities in Chad along the Chari and Logone rivers. We present findings addressing the following research questions and propose adequate BCTs for the design of an intervention campaign.

- What is the current situation concerning water treatment behavior in households and are there important environmental or technological factors influencing water treatment behavior in Chad?
- What are the psychological determinants for the promotion of water treatment at the household level and how should they be addressed in interventions?
- Can subgroups of people or disadvantaged groups be identified on the basis of differences in environmental/ technological, socioeconomic, and/or psychological factors?

2.2 Methods and Materials

Standardized structured questionnaires were administered in face-to-face interviews at 1,017 households split by location as depicted in Table 2.1 by a team of local interviewers recruited from the staff of the in-country non-governmental research institution Centre de Support en Santé Internationale (CSSI), most of whom had prior experience of participating in studies and carrying out interviews. The research team went through a full-week training program that included briefings on the general project objectives, theory, and application of the measurement procedure, and instruction in practical implementation skills on the ground such as introducing oneself to a household and asking for their participation. Training also included simulations and two full days of field work in a non-study area that also served for testing the research instruments and application procedures.

TABLE 2.1: Political regions of the study, number of interviews by Sub-Prefecture and corresponding total population.

Region	Sub-prefecture/ Zone of responsibility	Number of interviews	Total population (INSEED, 2009)
Hadjer Lamis	Massaguet	78	52776
City of N'Djamena	1ière arrondissement (Milezi)	79	75203
	8ième arrondissement (Diguel et Chagua)	159	184641
	9ième arrondissement (Walia)	100	75593
Chari-Baguirmi	Koundoul	83	38871
	Mandelia	70	49177
	Logone Gana	39	17380
Mayo Kebbi Est	Guelendeng	163	37242
	Bongor	246	69787
Total		**1017**	**600670**

The questionnaire was designed in French and completely translated into local Arabic by the whole team to guarantee shared understanding; special terms were also discussed together for cases where neither French nor Arabic was spoken in a household and local dialects had to be used. The application of the RANAS model approach was discussed with local experts, and the intelligibility of questions and rating scales were tested in focus-group discussions beforehand. The interview team was supervised by two additional superior staff members, as well as by the local and international researchers responsible throughout the whole process.

The interview covered questions on demographics and asked about water sources, current water treatment practices, and knowledge about water treatment technologies. Several items were constructed for each psychological factor to address all of the RANAS components in detail.

2.2.1 Eligibility criteria and choice of households

The eligibility criteria for participating households were to have a child under the age of 5 years living within the household, and to provide informed consent to participate in the study. Interviewees were primary caregivers (women in 95% of cases), defined as the person responsible for household chores and childcare. Households were chosen randomly by the interviewers within the sites using a modified random-route procedure (Hoffmeyer-Zlotnik, 2003), which involved being dropped off at different locations within the designated geographic-coverage area and then choosing a starting direction, addressing every third household along the way.

The study took place during two periods between December 2013 and May 2014 at a total of 10 study sites: Walia, Milezi, Diguel, and Chagua within the boundaries

of Chad's capital, N'Djamena; Massaguet, about 150 km north of; Koundoul, Mandelia, and Logone Gana, in the district of Mandelia; and Guelendeng and Bongor, at a distance up to about 300 km south of N'Djamena along the Chari and Logone river systems feeding Lake Chad as shown in Figure 1.1 according to recommendations from the Ministry of Health (MSP, 2013). This survey will later serve as a baseline for comparison of intervention strategy effects on behavior in randomized controlled trials.

2.2.2 Data analysis

To determine data-driven intervention strategies targeting at important behavioral drivers, the IP for each psychological factor of the five RANAS model's components was estimated analyzing statistical means between groups of performers (Doers) and nonperformers (NonDoers) of water treatment. Total population means as well as differences in means (t tests) between the groups of Doers (people who currently do perform water treatment) and NonDoers (people who currently do not perform water treatment) were calculated for all psychological variables. According to the "Guideline for Behavior Change," the IP for psychological factor components and their subscales results from the distance of mean value to scale maximum (Mosler, Huber, et al., 2013). For the present study, all factors falling at or below the mid 3-point value on a scale of 1–5 are considered important for the design of interventions, because of the remaining theoretical improvement reserve. In addition, differences between Doers and NonDoers of 0.5 points or more on the 5-point Likert scale will be addressed, representing a medium effect size referring to Cohen's notation (Cohen, 2013).

The IP is therefore calculated as a combination of the distance of the total mean from the desired scale maximum value (5-point scale end) as well as the difference between the group means. Analysis of variance tests were additionally run to confirm statistically significant differences in means between the groups of Doers and NonDoers for all five of the RANAS components. Values between 1 and 2 are considered as a low, 2–3 as a moderate, 3–4 as a high, and above 4 as a very high IP.

For the self-regulation component, groups of low-, mid-, and high-habituation Doers were compared, since questions about self-regulation cannot be answered by NonDoers. Subgroups were constructed according to primary water sources to identify any potentially disadvantaged groups showing major differences that could require special attention in an intervention campaign.

All calculations were computed using the IBM Corp. (Armonk, NY, USA) SPSS Statistics software package (IBM, 2010).

The study protocol was reviewed and approved by ethics committee boards at the University of Zurich, Switzerland, as well as by the responsible division of the Ministry of Health in Chad. Permission from local authorities had to be obtained for all individual study sites by informing the mayors, official chiefs of quarters and smaller living units, as well as religious leaders, especially in Muslim neighborhoods, by personal visits and by supplying them with copies of the in-country-approved study protocol. Verbal informed consent was obtained from all participating subjects due to high illiteracy in the study area.

2.3 Results

2.3.1 Study population

The mean age of the respondents was 31 years (standard deviation $[SD] = 11.6$) and the mean household size was 8.6 persons ($SD = 5.3$). On average, interviewed households possessed half (mean $[M] = 0.52$; $SD = 0.26$) of the eight items that were asked about (bed, table, electricity, radio, television, refrigerator, motorized vehicle, and phone) to generate a socioeconomic score (range: 0–1). Details on religion, education level, and literacy rates, as well as results from eight knowledge questions on water treatment, can be found in Table 2.2, with differences between the groups of Doers, NonDoers, and NonDoers using traditional wells.

TABLE 2.2: Characteristics of the study population, separate for the groups of Doers, NonDoers, and NonDoers with wells as the primary water source.

		Means			
		Total	Doer	NonDoer	NonDoer (open wells)
Age		31.4	31.8	31.3	31.7
Household size		8.6	8.7	8.4	10.3*
SES score (0–1)		0.52	0.59	0.51*	0.25*
Knowledge score water treatment (0–8)		5.17	5.39	5.14*	4.40*
		Percentage			
		Total	Doer	NonDoer	NonDoer (open wells)
Religion	Muslim	52.7	54.5	54	29
	Catholic	17.7	15.9	19	13
	Protestant	24.3	28.9	22.6	20
	Animiste	4.9	0.3	4.1	39
Educational level	No school visited	42.4	32.2	45.8	58.9
	Koranic school	6.7	8.3	6.5	0
	Primary level	20	22.6	18.5	23.2
	Secondary level	23.7	28.2	23.1	7.1
	Superior level	4.4	6.3	3.6	3.6
Literacy	Can read and write	39.3	50.8	35.7	17.9

Note. *depicts significant deviations (P < 0.5) from the group of Doers.

To address the questions about current water treatment practices and factors determining their application, we asked about what the sources were for household drinking water, knowledge of methods to perform water treatment, and current self-reported water treatment practices. Primary water sources used for the supply of drinking water in the sample included mechanical or electric pumps from deep and protected wells (55.7%); private or public water taps (25.8%); traditional, unprotected, and shallow wells (5.8%); delivered water from water vendors (3.5%); and surface water such as lakes and rivers (3.4%) (Table 2.3). Over half (55%) of all interview partners did not state a single water treatment method. Among the persons who knew at least one method, nearly all (95%) mentioned chlorine in one of its forms (liquid, powder, or tablets). Other known methods were boiling and filtering (< 5%). A total of 304 households representing 30% of the full sample reported currently treating their drinking water (Doers). When asked for the applied method, over 95% answered that they were using chlorine products.

Differences for the primary water sources could be found between settings (Table 2.3). This becomes clearly visible for the town of Bongor, where both central and peripheric quarters were independently selected for the survey. Elevated percentages of users of modern pumps and piped water systems (taps), compared with traditional open wells and surface water sources for the capital city of N'Djamena, represent a higher level of development and show the importance of available infrastructure for people's options and their choice of water sources.

TABLE 2.3: Primary sources for drinking water for the full sample and according to specific regions.

		Percentage				
Primary source	N	Total (N=1,017)	NDJ (N=380)	Other than NDJ (N=614)	Bongor central (N=119)	Bongor peripheric
Pump	566	55.7	61.2	52.9	17.5	38.3
Tap	262	25.8	22.5	27.4	73.8	2.5
Open well	59	5.8	0.6	8.4	1.6	40
Vendor	36	3.5	8.6	1	0.8	0
Surface	35	3.4	1.2	4.6	0.8	15
Not classified	59	5.8				
Total	**1,017**	**100**				

Note. Fifty-nine households (5.8%) could not be classified unambiguously due to more than one source being used. (NDJ = N'Djamena)

The traditional way of storing drinking water in homes in the region are ceramic jars placed either directly on the ground or on a rack that keep the water cool, which are routinely refilled with fresh water. Alternatively, plastic containers are used such as jerry cans or simple buckets. Water for drinking is habitually served by dipping a smaller cup into the container by hand, oftentimes making contact between the hand and the water body and thus representing a possible source of recontamination of the stored water. Although a majority (62%) of water storage containers were found covered with a lid, traces of visible dirt were found in every second (48%) container during structured household observations. In addition, the heavy weight of the ceramic jars impedes their frequent cleaning.

The second research question asked for the assessment of behavioral determinants for the future promotion of water treatment. The position of total means as well as differences in means on the standard scale were used to estimate the IPs for all psychological components of the RANAS model (Mosler, 2012) for the targeted water treatment behavior, perceived vulnerability was measured using six items (Cronbach $\alpha = 0.938$) asking about general, personal, and children's risks of contracting diarrheal diseases and cholera (scale range for all questionnaire items from 1 = very low to 5 = very high). On average, perceived vulnerability was rated rather low ($M = 2.35; SD = 1.13$). This result was equal for both Doers and NonDoers of water treatment. Severity (two items; $\alpha = 0.863$), described as the consequences of contracting diarrheal diseases, was rated as moderately severe ($M = 3.05; SD = 1.25$). Again, no great differences could be observed between groups of performers. Knowledge about risks and disease was assessed using four questions on causes, effects, treatment options, and preventative measures for diarrheal diseases. The mean score on knowledge was moderate ($M = 2.93; SD = 0.97$), again with only small differences between the groups of Doers and NonDoers. All three factor scales result in a moderate IP for this component. All results are displayed in Figure 2.1 at the end of this chapter.

Both of the attitudinal subscales, instrumental beliefs about costs and benefits of water treatment ($\alpha = 0.539$, four items and $\alpha = 0.837$, five items, respectively), revealed rather high scores. On average, respondents generally had positive thoughts toward water treatment and did not find it very expensive or time-consuming, nor

effortful (average $M = 4.05; SD = 0.85$), and its positive outcomes compared with its costs were also rated as quite beneficial (average $M = 3.67; SD = 0.97$). The taste of treated water was generally rated higher ($M = 3.83; SD = 0.85$) than that of untreated water ($M = 2.98; SD = 1.34$) by both groups. The IP for all factors within this component is therefore low.

The perception of how common water treatment behavior is seen within the communities was very low (descriptive norm; $M = 2.19; SD = 1.00; \alpha = 0.816$; two items). The injunctive norm factor showed equally low values ($M = 2.21; SD = 1.00; \alpha = 0.609$; three items), representing people's experiences of how strongly water treatment is promoted by important persons such as state and religious authorities. However, the personal norm factor (how important water treatment is rated personally) was higher, with a medium scale average ($M = 3.23; SD = 1.02; \alpha = 0.547$; two items). The two items on social discourse about water treatment ($M = 2.88; SD = 1.54$) and social support supplied by the head of household to the primary caregiver in performing it ($M = 1.48; SD = 1.21$) also showed moderate to low overall means, as well as large differences between Doers and NonDoers of up to 1.4 scale points. All norm factors showed significantly higher values for the group of Doers. Normative factors therefore reveal a moderate to high IP, both from an overall means perspective and from differences between groups of performers.

Ability factors, measuring people's perceptions of their own skills to pick up and maintain water treatment behaviors and to recover from drawbacks (self-efficacy), were found to score in the medium range ($M = 2.97; SD = 1.12; \alpha = 0.890$; five items). Differences of 0.8 scale points between groups of performers depict a moderate IP.

Self-regulation factors (not shown in Figure 2.1) were only assessed for the group of Doers, since questions about action control of, and the level of habituation to, an existing behavior only make sense to people already performing this behavior. Therefore, to assess the predictive power of self-regulation factors for water treatment behavior, differences were calculated within the group of Doers between those who expressed high-, mid- and low-habituation water treatment behavior (generated from three items on habituation). While the average among all Doers for action control ($M = 3.57; SD = 1.09; \alpha = 0.723$; two items) and commitment ($M = 3.94; SD = 0.68; \alpha = 0.644$; four items) was generally high, moderate differences between groups of performers point toward possible IP.

2.3.2 Subgroup analysis

To address the third research question about special groups of interest, the sample has been divided into subgroups depending on socio-demographic and technological factors. Differences in water treatment behavior could be found between regions, comparing the city districts of N'Djamena (35.5% Doers) with the remaining sample (27.8%) and more so between the urban (26.4%) and rural (11.7%) quarters of Bongor. However, the lowest rate of water treatment (5.1%) was found for the group of open-well users currently not performing water treatment (Figure 2.1; "NonDoers open wells"). Further investigation of this subgroup was subsequently run. Generally, this subgroup was represented more strongly within the rural study sites, where the population lives in a more traditional and oftentimes poorer or less developed environment. Manual or electronic protected water pumps are found less often in these areas than along the major roads and more densely populated urban sites.

Concerning socio-demographic variables, the subgroup of open-well users currently not performing water treatment also showed lower levels of education, lower

literacy rates, lower socio-economic status, larger household size, and lower scores on the knowledge test on water treatment (Table 2.2). Differences in psychological factors for water treatment behavior are displayed in Figure 2.1. Perceived vulnerability was rated higher by this group, representing a stronger concern for personal health threats from diarrheal diseases, which were rated as severe by this group as they were by the rest of the sample. All other factors showed lower scores for the group of traditional-well users, revealing a less favorable mindset for water treatment behavior than the rest of the sample. Extremely lower scores for this subgroup were found in the items of perceived price (attitude) and difficulty (ability) of water treatment (Figure 2.1).

2.4 Discussion

A cross-sectional survey using standardized structured questionnaires based on the RANAS model was applied to a sample population of over 1,000 households within the Lake Chad region, to assess psychological determinants and technological factors for water treatment behaviors.

Water treatment methods, mostly chlorine products, were used by about one-third (30%) of the studied population. This low rate matches findings from focus group discussions and anecdotal information that people only add chlorine to their drinking water in times of current cholera outbreaks and do not see the necessity of constant application. Two knowledge tests within the questionnaire revealed moderate to low levels of understanding about the causes and symptoms of treatment, and preventative measures against diarrheal diseases. Knowledge of water treatment methods was also low to non-existent within a great proportion of people living in the study area: over half of the interviewed persons could not name a single measure to disinfect drinking water.

Important findings for making an evidence-based decision on the choice of BCTs to promote household water treatment came from the analysis of psychological determinants, people's thoughts and attitudes concerning the application of treatment methods expressed in the interviews.

Respondents did not see themselves at high risk for diarrheal diseases, including cholera, despite the high prevalence of diarrhea in the study population. Because of the fact that no cholera cases had officially been observed in the study region in the 2 years prior to the survey, it did not make sense to assess short-term cholera prevalence. When asked about all diarrhea cases within the previous week (a 7-day recall period), 43% of all households reported at least one episode, almost always affecting a child under the age of 5 years. This discrepancy might be explained by the fact that despite this high self-reported prevalence, over half of the interviewees were rather or completely satisfied with the current health situation of their families, and not or only a little anxious about their future health situation. Although symptoms of diarrhea are generally known, the perception of their severity is only rated as moderately severe on average. It appears that health problems, especially related to diarrhea, are not seen as highly relevant problems despite their omnipresence and recurring episodes of cholera with high death tolls in the country. Together with the low level of knowledge displayed about disease and preventative measures, the low overall perceived vulnerability results in an important IP for the risk factors. Thus, strategies to sensitize the population to existing health risks and inform them about water treatment technologies, combined with instructions on how to apply them, should be considered in the design of an intervention campaign.

High average values for the attitudinal factors, in combination with small differences between groups of performers, result in only a small IP for this component. Therefore, no specific strategies will be proposed. In addition, the groups of Doers and NonDoers both reported preferring the taste of treated water and rated it higher than the taste of untreated water. This is especially important for the promotion of chlorine, since it can strongly affect the taste of water.

The highest IP could be found for the norm component, addressing normative perceptions about how well-established water treatment is within communities, how much it is promoted, and how important it is seen personally. The lowest mean values were found for all sub-scales of this psychological component, as well as for individual items asking about social support and normative discourse. Large differences between Doers and NonDoers in norm factors undermine this. This finding can be directly linked to the low rate of performers (30%), which makes it understandable that the perception of existing water treatment within communities is higher where it is seen more often. People who already perform water treatment seem to experience higher social norms, social acceptance, and even social pressure for, and discourse about, doing it. Normative factors therefore seem to play an important role in the formation of water treatment behaviors and the establishment of habits, and should therefore be addressed using corresponding BCTs to encourage their uptake and maintenance.

Ability factors revealed moderate IP; in particular, the lower perceived self-efficacy in performing water treatment among the NonDoers compared with the Doers speaks for the inclusion of a corresponding BCT. NonDoers could be persuaded to start water treatment when equipped with the necessary knowledge (see above) and the required skills and demonstration of performance, leading to an elevated perception of self-efficacy.

By looking for distinct sub-samples and potentially disadvantaged groups, we found water treatment behaviors to be significantly lower within the group of traditional well users, of whom only 5% reported current water treatment compared with the overall rate of 30%. This finding reflects the decrease in water treatment behaviors that could already be observed between more urban and rural areas within the town of Bongor, but is still extremely low. Detailed analysis revealed that knowledge about disease and prevention was also much lower in this group.

Traditional-well users (95% of whom are NonDoers) also showed significant differences (see Figure 2.1) in other psychological determinants for water treatment, which in turn calls for adapted intervention strategies specifically tailored for this sub-population. Higher scores in this subgroup than in all other groups could be found for the factor of vulnerability. At first glance, this is surprising when compared with the low rate of water treatment found for this group. One would probably expect a rather higher behavioral rate. However, the low rate of water treatment could explain the higher risk perception, because these individuals know that they almost entirely do not treat their drinking water, they might be aware of their higher risk. The consequences of diarrhea were rated equally as severe by this subgroup as by the rest of the sample, which once again underscores the distinct difference in vulnerability.

All other results were generally lower but revealed a similar perspective for the design of intervention strategies. From an intervention perspective, the results revealed higher considerable IPs for the same factors as for the full sample reported earlier. Extremely lower scores in the subgroup were found for the items of perceived price (attitude) and difficulty (ability) of water treatment, which would require additional intervention elements. BCTs aiming at changing price perception

and at fostering expected self-efficacy would be appropriate means to tackle these factors.

Looking at socio-demographic and economic variables, this subgroup on average showed both lower levels of education and lower socio-economic scores based on household possessions. The users of traditional wells participating in this study could thus represent a potentially disadvantaged, generally poorer group that also lives in poorer sanitary conditions in rural settings. Special attention might need to be paid to this group, since the poorest of the poor often go unserved, and equality issues have increasingly been raised within development projects (Wisner, 2004). Adding supplementary strategic elements to a behavior change campaign, however, will always add to the costs and will strain the available resources. The small proportion of traditional-well users within the full sample (6%) will raise the question of cost-effectiveness and should be carefully discussed before taking action. In addition, this group will profit from the general strategies proposed.

2.4.1 Implications for practice

The results will be shared with all project stakeholders, namely the WHO headquarters and country office in Chad, the Ministry of Public Health in Chad, and the CSSI, the local NGO in charge of the field work, to discuss plans for further precipitation of the development of intervention strategies. To foster the adoption and maintenance of water treatment at the household level, we propose several BCTs to be applied, according to the guidelines derived from experience in several projects in developing countries (Mosler, Huber, et al., 2013).

Personal risk perception, social norms as well as encouragement by the authorities and influential persons, and perceived self-efficacy have been found to be the most important factors affecting water treatment behaviors within the local context.

In particular, the two factors of descriptive and injunctive norm perceptions revealed the greatest differences between performers and non-performers of water treatment, thus showing their importance for the promotion of this behavior within the study population. The importance of normative factors for the promotion and adoption of key WASH behaviors has been demonstrated in several other projects in developing countries, and commitment-enhancing behavior change strategies for safe water consumption have been successfully implemented. Basic effects can also be expected from standard information BCTs (Inauen & Mosler, 2013; Tamas, Meyer, & Mosler, 2013; Inauen, Tobias, & Mosler, 2013b).

Based on these results, we propose a 2-fold strategy in the given setting for the promotion of water treatment using chlorine, drawing on a combination of several BCTs. To target personal risk perceptions, information about sources of contamination, the role of water (especially household water stored for consumption) in disease pathways, and the preventative role of water treatment against diarrheal diseases should be diffused. As radio seems to be the most common mass media communication channel, most of the intervention messages could be delivered this way. In addition, we propose testing the supplementary effects of community meetings, where normative elements can be reinforced by inviting local authorities to attend and to publicly announce their approval.

By giving a demonstration of how to apply chlorine together with information about where to buy it, sources of self-efficacy, one of the key components for behavior change, will be activated, addressing the ability factor (Bandura, 1991). Personal norms and commitment toward water treatment can be further strengthened by asking for a public pledge, which is effective in two ways. First, because this pledge is

done in public, normative factors are again addressed. Second, people will be given signs to place on the outside of their houses to show all passers-by that "more and more" people are engaged, thus changing descriptive norms. For the public commitment, we suggest inviting not only the primary caregivers responsible for water treatment but also the heads of households. Since support by the household's head (male in 95% of cases) showed such a high IP and they are responsible for the purchase of chlorine, their commitment should have a strong but distinct effect on a caregiver's commitment, but this will not have any impact as long as technological means are not available.

2.4.2 Limitations of this study

Self-reported measures are always subject to bias due to social desirability and comprehension issues, especially in multinational and multicultural settings. However, the large sample size and planned longitudinal design of the complete study program allow us to deal with this issue by comparing only differences between intervention groups, thus controlling for these effects.

Currently, we only dispose of cross-sectional data to assess psychological factors and the design of intervention strategies for behavior change; however, longitudinal data will be necessary to 1) confirm the correctness and stability of these findings and 2) evaluate their correctness by measuring the effects of those strategies on actual behavior change. In addition, these findings are always bound to the local context; therefore, the question of generalizability for larger intervention areas might be limited and should always be accompanied by additional surveys prior to the application of BCTs. Different environments and the sociocultural compositions of local populations can vary even within one country, in terms of needs and psychological structures. Consequently, applied interventional strategies should always be developed in a population-tailored manner to match the particular characteristics.

Conclusion

For the first time, a structured and representative survey on behavioral determinants for water treatment behavior has been applied to a region at high risk for cholera in Chad. This approach allows for informed and evidence-based decision making on appropriate intervention strategies to support the government of Chad in its efforts to fight and control cholera and other diarrheal diseases. Tailored intervention strategies for the masses can also be designed based on these findings, addressing exactly those psychological factors that have been shown to be of high importance for the adoption and maintenance of water treatment behaviors within the local study population. In addition, important subgroups with specific characteristics have been identified, revealing special needs that should receive additional attention. Risk perception, social norms, and perceived self-efficacy have been identified as the strongest predictors for behavior changes concerning water treatment in western Chad, and should therefore be addressed in future efforts for its promotion.

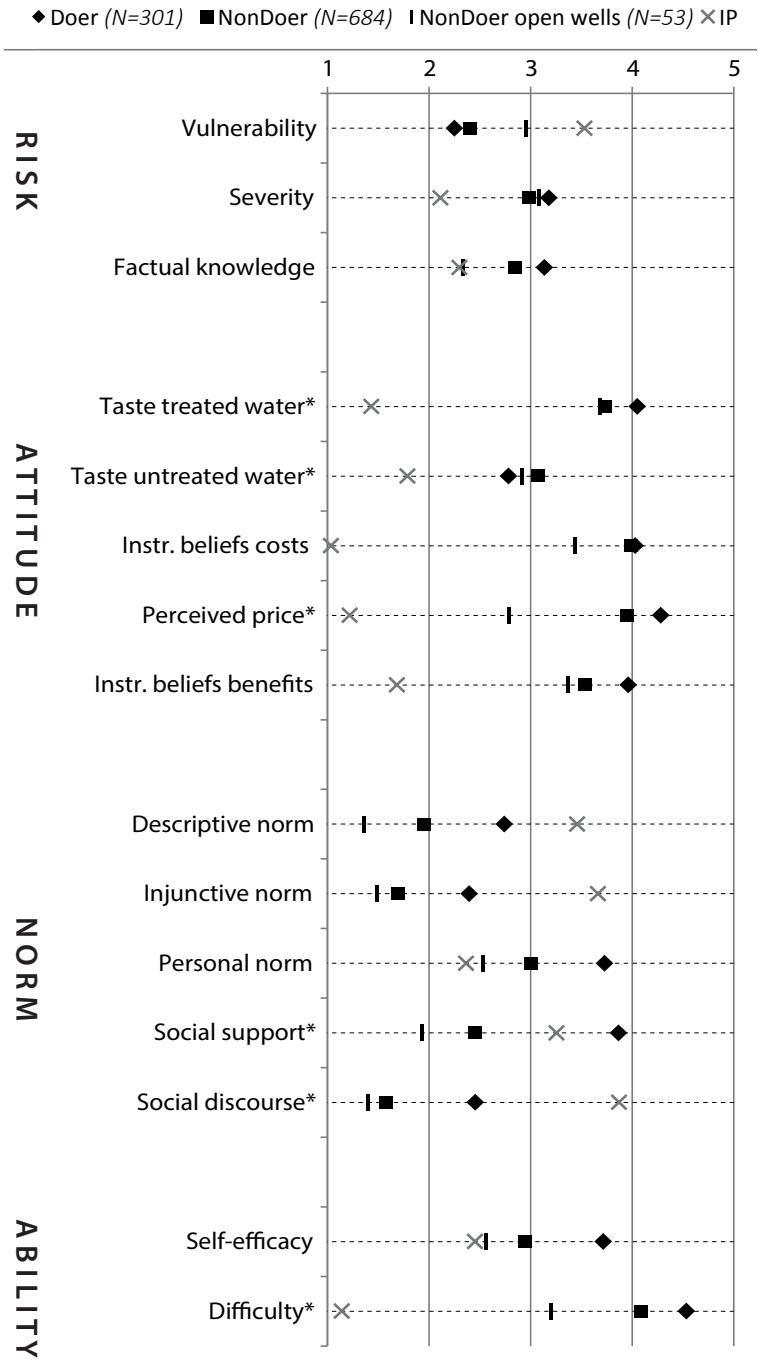

FIGURE 2.1: Graphical overview of the results of the RANAS (Risk, Attitude, Norm, Ability, and Self-regulation) factor analysis. Statistical means for the groups of Doers ($N = 301$; diamonds) and NonDoers ($N = 684$; squares), as well as for NonDoers using open wells ($N = 53$; bars), as well as the intervention potential (IP; crosses) are displayed for comparison for all sub-factors. Individual questionnaire items (*) are displayed where important differences were found between groups. Note that all items were standardized and recoded so that a high score represents a favorable result for water treatment behavior (e.g., high instrumental beliefs or low perceived price).

Chapter 3

Continuation of health behaviors: psychosocial factors sustaining drinking water chlorination in a longitudinal study from Chad

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Abstract

Behavior that has changed following promotion campaigns is usually not maintained at its initial level. Psychosocial factors for initiating behavior are often not the same as for the continuation of health behaviors such as water treatment and are much less understood. Better knowledge of factors for behavioral continuation would help to improve programs, both in the design of strategies for sustainable behavior change and by defining stronger criteria for the evaluation of sustainability. This study compared the mindsets of caregivers who continuously performed household drinking water treatment over time with individuals that stopped doing so in a population sample from Chad. Several factors from health psychology based on the Risks, Attitudes, Norms, Abilities, and Self-Regulation model were used to compare the two groups and examine their differing development. Normative factors such as others' behavior, personal obligation, social support and discourse, perceived self-efficacy convictions, action control, and intention best discriminated between the two groups and developed significantly more positively over time for continuers of water treatment. These factors should be considered when designing future interventions intended to lead to sustainable behavior change.

Keywords

Behavior change, health psychology, behavioral continuation, drinking water, WASH

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3.1 Introduction

Globally, an estimated 1.9 billion people either use an unimproved water source or an improved source that is fecally contaminated (Bain, Cronk, Hossain, et al., 2014; Onda et al., 2012; WHO & UNICEF, 2010). Despite some progress in attaining the Millennium Development Goals concerning the provision of safe drinking water, the number of people in rural Africa without access to safe water has actually grown between 1990 and 2006 from 243 to 272 million (Lockwood, Smits, Schouten, & Moriarty, 2010). Limited access to safe drinking water represents a major health risk in many low- and middle-income countries, where unsafe drinking water is held responsible for over half a million deaths from diarrhea yearly (Ndé-Tchoupé, Crane, Mwakabona, Noubactep, & Njau, 2015). Among those, cholera is a leading cause with 100,000 – 120,000 deaths alone yearly among 3 – 5 million cases and potentially 1.4 billion people living at risk in endemic countries. Unsanitary conditions and lack of access to safe drinking water sources and adequate sanitation are seen as major risk factors (Prüss-Ustün et al., 2014).While several pathways of disease transmission through contaminated drinking water are known, interventions at the source level and water treatment and storage systems at household level (HWTS) both provide immediate, temporary solutions to improve the quality of drinking water where piped systems are not available. The latter options are usually affordable and easy-to-use technologies that can be applied by individuals independent of the origin of the water (Clasen, Schmidt, et al., 2007). To be effective, however, these solutions rely on their correct, consistent, and continued application (WBG, 2015). Even slight declines in compliance, for instance small amounts of untreated water consumed on a few days in the year, can cause up to 90% of the expected beneficial effects of water treatment to vanish (Clasen, 2015). It is therefore essential to couple the provision of technological solutions with behavior change campaigns (Kaminsky & Javernick-Will, 2015; Sonego, Huber, & Mosler, 2013; Whaley & Webster, 2011).

Behavior change strategies attempt to address key drivers or motivators in local populations to foster the adoption and continued usage of targeted technologies and related behaviors. Behavior change strategies based on psychosocial surveys which are tailored to the local populations' mindsets have been shown to outperform standard approaches, which often only address risk awareness and a few other factors such as knowledge of disease prevention (Contzen & Inauen, 2015). Several factors at the personal and social level, such as social norms, status, self-efficacy convictions, and the like, have been shown to be important predictors for the success of promotion campaigns targeting a range of health-relevant behaviors (Contzen & Mosler, 2013; Inauen & Mosler, 2013; Kraemer & Mosler, 2012). Successful promotion strategies have also been shown to surpass outside stakeholders' project goals and definitions of outputs by rather taking into account multiple perspectives, especially local populations' views, attitudes, motivators, and fears (Marshall & Kaminsky, 2016).

Health psychology theory can help to identify and assess key drivers for health behaviors across countries and cultures. One integrating framework is the Risks, Attitudes, Norms, Abilities, and Self-Regulation (RANAS) model, which has been designed specifically for deployment in developing countries (Mosler, 2012). It incorporates elements from a variety of established health behavior theories. By operationalizing and comparing several psychosocial factors between performers and non-performers, it can help to identify the relevant drivers of behavior in a given population sample. While the initial uptake or adoption of a new or alternative behavioral option is one aspect, the other is its sustained usage or continuation over time. A behavior change process can therefore be divided into a) initiation of new

behaviors and b) their continued usage over time, sustained by prevention from relapse, a process which can eventually lead to habit formation (Abraham, 2008). However, factors that lead to behavioral continuation are often not the same as for initial uptake; Further, such factors are less understood from a health psychology perspective (Rothman, Baldwin, Hertel, & Fuglestad, 2004) which could be a reason why many programs fail to sustain behavior change.

Compared to behavioral uptake, the subsequent process of behavioral continuation has clearly been understudied to date but should be of particular interest from several perspectives. Intervention campaigns should not only target factors for initial uptake but also those which promise long-term behavior change so as to close the gap often reported in the literature between successful initial uptake and failure to improve behavioral maintenance (Rothman, 2000). A more accurate knowledge of factors important for the continuation of health relevant behaviors could enhance existing behavioral models and expand the scope of practical campaigns developed from them.

Further, many programs do not follow up after an initial behavioral promotion or measure only short-term goals. A better understanding of factors for behavioral continuation can help to define criteria for measuring success in the long term. From a public health perspective, it is of great interest that programs not only understand factors driving initial behavior change but also guarantee long-term continuation to efficiently concentrate funds on reaching sustainable project goals.

A previous study in Chad examined the psychosocial factors explaining behavioral uptake of drinking-water chlorination as a means to prevent cholera outbreaks. The most important factors for the promotion of drinking water chlorination were risk perceptions, social norms, and self-efficacy convictions ,which differed significantly between survey participants who were performing water treatment and those who were not at the time of survey (Details can be found in Lilje, Kessely, and Mosler, 2015).

In this study, we are interested in the process of behavioral continuation We examine which behavioral factors play an important role in maintaining behavior by utilizing the baseline data from (Lilje, Kessely, & Mosler, 2015). To observe what changes in psychosocial factors occurred over time in different user groups, a second survey was conducted in the same study sample. No further interventions had taken place in the meantime.

This study may help to foster an understanding of which individual-level factors explain the continuation of health behaviors such as drinking-water treatment. This may improve behavior change programs by focusing campaigns on psychosocial factors relevant to behavioral continuation and by defining long-term goals for program evaluation.

The main objectives of this study is to examine psychosocial factors for drinking water treatment in a sample population over time. The objective is to identify psychological factors for behavioral continuation. We compared people who continued drinking water chlorination with people who stopped treating their drinking water to identify differences in the mindsets of the different groups. We show a) which factors differ between the two groups initially, b) which factors change over time, and c) which factors develop differently for those people who continue water treatment compared to those who stop doing so. Therefore, we address the following research questions in our analysis:

- Which psychological factors show differences between those continuing and those stopping water treatment?

- Which psychological factors change over time when people continue or stop water treatment?
- Which psychological factors change differently over time between the two groups?

3.2 Materials and Methods

The field research was carried out in communities in the Lake Chad Basin, a region frequently hit by cholera epidemics where securing access to safe drinking water is one of the highest priorities (Richard et al., 1999). A number of sites were chosen in both urban and rural settings in Chad, in a region near the frontier with Cameroon and bordered by a two-river system, the Chari and Logone. The urban sites were neighborhoods of N'Djamena, Chad's capital city with a population of about 3 million; rural sites were located along a 400 km strip north and south from there. Target communities were chosen based on recommendations by the Ministry of Health in Chad. In 2004, the national level of access to safe drinking water was 51%; however, large differences exist across the country (Ouagadjio et al., 2004). According to 2015 figures 72% of the urban population and 45% of the rural population had access to improved water - which is not necessarily safe (JMP, 2015).

Households in which a child under the age of 5 years was living at the time of the baseline survey were eligible to participate in the study. Young children usually carry the largest burden of diarrheal disease and so benefit most from improvements in water, sanitation, and hygiene (Robert E. Black, Morris, & Bryce, 2003; Wardlaw, Salama, Brocklehurst, Chopra, & Mason, 2010). Households were chosen based on a random route procedure (Hoffmeyer-Zlotnik, 2003). The baseline survey will hereafter be referred to as "survey 1" Assisted face-to-face interviews were conducted with the primary caregiver in charge of childcare and household work, most of whom were female (95%). On average, participants were 31 years of age (standard deviation $(SD) = 11.6$) and 8.6 ($SD = 5.3$) persons shared one household.

Data on survey 1 was collected during two distinct periods due to rescheduling during the project. The first 600 households were interviewed in Chad in November and December 2013. Although it was originally planned to survey the same number of households on the Cameroon side of the river system, this plan had to be dropped due to security issues arising at the end of 2013. Instead, another 400 households were interviewed further south on the Chad side in the Mayo Kebbi Est district. In total, interviews with 1017 primary caregivers were conducted in survey 1. A structured questionnaire of one hour's duration was administered using electronic tablet devices. The local study team, comprising two field supervisors and ten interviewers, received seven days' training on the study rationale and on using the survey instruments, including a piloting phase in the field. Follow-up data were collected in an evaluation survey in October/November 2015 ("survey 2").

The original study sample size was reduced for this analysis, for several reasons. During the baseline study, only 304 (30.0%) of all interviewees stated that they used some kind of water treatment in their household. This group is the sample of interest for this study. Of these households, 213 (70.1%) could be interviewed during the second survey. Dropout occurred for several reasons; many households had moved away, were not present during the days of the follow-up assessment or could not be interviewed for other reasons (refusal, contact details no longer valid, etc.).

Between the two surveys, an intervention campaign was planned and carried out by the Ministry of Health in collaboration with local health care facility staff

to promote drinking water chlorination based on the World Health Organization's guideline for drinking-water quality (WHO, 2011). However, that intervention only reached a minority of the sample under study here. Households that participated in the Ministry's promotion activity were excluded from the present analysis ($N = 15$). This leaves a 197 households that are eligible for inclusion in this sample. Of these, 86 (43.7%) reported that water treatment was still done in their households, while 111 (56.3 %) did not report any water treatment activity at the time of the second survey. The first group will hereafter be referred to as "continuers" of water treatment; the second group will be termed "stoppers".

The survey covered general information on individual subjects' and households' demographics, assessed wealth, available water sources, knowledge of water treatment technologies, and self-reported water treatment behavior. It also contained questions about a number of psychosocial concepts that are used to measure behavioral factors concerning drinking water treatment. Key terms and questions were translated into local Arabic and other languages spoken in the region together with the team of interviewers to guarantee uniform understanding. Questions on psychological constructs were generally answered on a five-point rating scale with predefined responses from which the interviewee was asked to choose the most appropriate.

The psychological concepts included in the survey instruments are briefly described below. Definitions of factor blocks were taken from the framework guideline (Mosler & Contzen, 2016). Individual questionnaire items were combined to form scales for each psychological construct. Table (1.1 in the appendix shows) the factor blocks, factors, and exemplary items for each factor, the answer format, number of items, and scale reliability where items were combined. The scale range for all items was standardized to form a uniform range from 1 as minimum to 5 as maximum scale values; items with a reverse answer format were recoded to provide consistently structured scales.

The block of risk factors addresses a person's understanding and awareness of the health risk. This includes individuals' perceptions of their susceptibility to diarrheal disease and the estimation of the severity of its consequences to their own health and life. It also includes basic health knowledge about sources of disease and disease transmission, as well as what can be done to prevent disease.

Attitudinal factors represent a person's positive or negative stance towards a behavior. In the present study, taste perceptions of treated and untreated water were of interest. Further, potential or perceived costs and efforts compared to the benefits of treating drinking water were assessed.

Norms represent the perceived social pressure towards a behavior. Existing social norms are one of the strongest influences for health behaviors in people, as has been shown in a recent review (Lilje & Mosler, 2017). The RANAS model therefore addresses three dimensions of normative factors. One is the perceived behavior of others, for instance, how many other people perform or do not perform a behavior. Another dimension is how far others approve or disapprove of a certain behavior and whether it is publicly encouraged, for example, by influential people. A third dimension is the strength of an individual's own obligation, what one thinks he or she should or should not do. In this study, two additional factors were added to the RANAS norm block. Social support describes how strongly an individual is supported in his or her attempt to perform a certain behavior. In this study, the questions concerned perceived social support, describing not necessarily the actual support the individual received in treating drinking water but how much he or she felt supported (Sarason et al., 1990). A second question concerned the frequency

with which drinking water treatment is or was a topic of discussion among subjects. This is termed "social discourse".

Abilities represent a person's confidence in her or his ability to practice a behavior. Ability factors address the concept of self-efficacy, which is seen as one of the key determinants in all stages of behavior change (Schwarzer, 2008). The ability factor block includes a subject's knowledge of how to carry out and perceived confidence in carrying out the steps necessary for a behavioral goal, to deal with difficulties that might arise or to recover from drawbacks or from having stopped to perform the behavior (action, maintenance, and recovery self-efficacy).

Self-regulation represents a person's attempts to plan and self-monitor a behavior and to manage conflicting goals and distracting cues. This includes making plans to facilitate the behavioral execution in the future and on how to cope with arising difficulties. It also comprises self-monitoring activity; that is, checking on oneself' s progresses or lapses and reminding oneself of existing intentions. Commitment captures the concept of personal dedication towards a behavior, which can itself moderate behavior (Tobias, 2009). Habit further captures the extent to which a behavior is executed automatically, without having to consciously think about it. The higher the level of habituation to a certain behavior, the more likely it is to be executed in relevant situations due to the automatic activation of learned patterns (Neal, Wood, & Quinn, 2006). Habit can be seen both as an outcome of previous behavioral factors and as a predictor of behavior (Tobias, 2009).

Lastly, individuals' intention to treat water was captured as the level of their volitional strength (Ajzen, 1985). Intention can be regarded as the outcome of certain of the previous constructs, but it can also act as an intermediate variable in explaining behavior. Current self-reported water treatment behavior was measured by asking the question "Do you do anything to make the water [designated for drinking in the household] safe to drink?". Further, reasons for treating or not treating water were inquired using open-end questions.

General linear models (GLM) for repeated measures were calculated to examine a) differences in means between groups of users, b) differences in time between the surveys, and c) differences in groups over time.

The first analysis compares the overall means of the two user groups over both surveys. Significant results for a given factor show a general difference between the two groups that exists disregarding the time factor. The second analysis compares the mean values between the two surveys disregarding group differences and thus only shows general increases or decreases over time. This represents the development of factors from baseline to follow-up assessment for both user groups taken together. The third analysis examines differences between the two groups and between the two surveys. It analyzes whether the means of the two groups develop differently over time and is represented by the interaction term between group and time. These three steps of analysis were run for each individual factor separately. The threshold for significance was corrected at $alpha = .0025$ for multiple comparison with 29 factors (Cohen, 2013). All calculations were run using the IBM Corp. (Armonk, NY, USA) SPSS Statistics software package.

The field study was approved by the Ethics Commission at the University of Zurich, Switzerland. In-country research authorization was obtained from the Ministry of Health in Chad. Local authorities were briefed and asked for permission at each step of the survey. Oral informed consent was obtained from participating subjects due to high illiteracy in the study area.

3.3 Results

Figure 3.1 depicts a graphical representation of the survey results for all psychological factors, showing the mean values for the answers of the two groups of continuers and stoppers at both surveys. The scale range is 1 to 5 and all factors have been standardized and recoded so that 1 always represents the scale minimum and 5 represents the maximum possible value. Low values stand for less favorable results concerning water treatment behavior. For example, a low personal risk perception for diarrheal disease, weak social norms, and high perceived costs of drinking water chlorination are all interpreted as reducing the probability of a person performing water treatment. Higher values are more favorable for the target behavior. High perceived benefits, low costs, high social norms, and strong intention or commitment to drinking water treatment is expected to correlate with a high probability of that person performing water treatment.

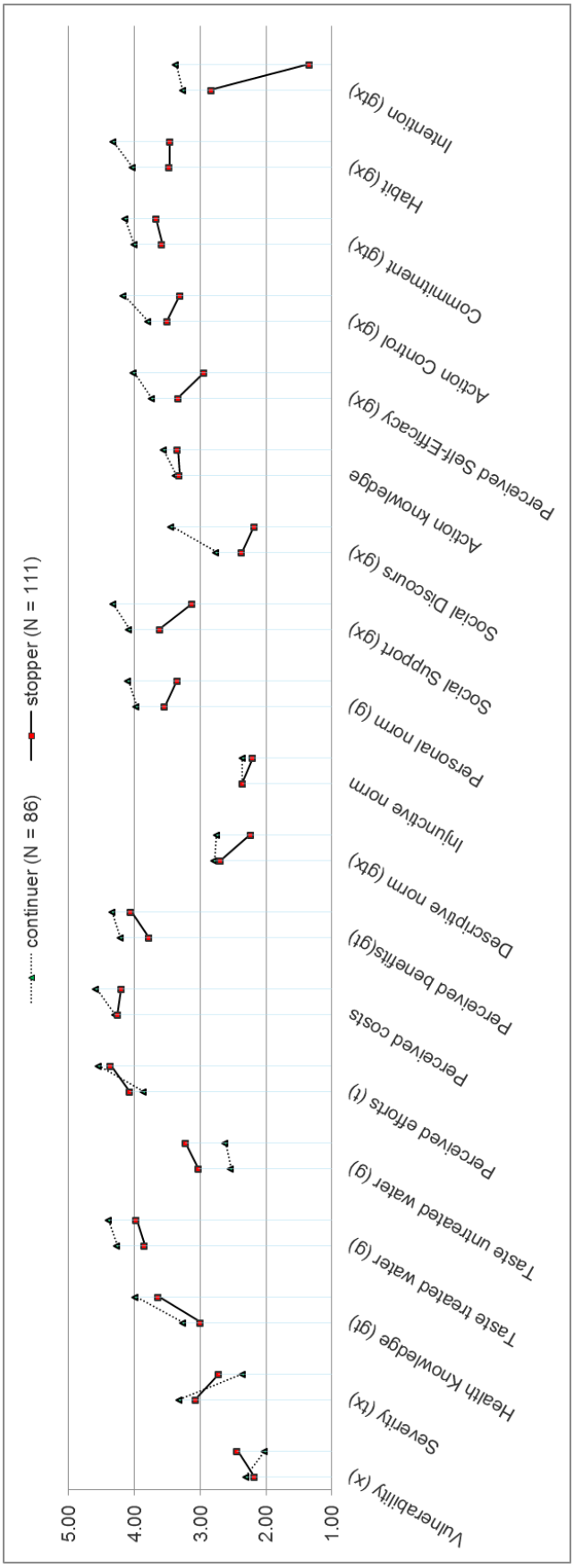

FIGURE 3.1: Graphical representation of results for all psychological factors divided by continuers (N = 86, triangles) and stoppers (N = 111, diamonds) of water treatment form survey 1 to survey 2. Note. (g) = significant group effect, (t) = significant time effect, (x) = significant interaction effect between group and time

We first look at the results in three different ways. First, we compare the average mean values between the two groups of continuers and stoppers of water treatment globally over the two surveys. Secondly, we examine whether any changes occurred over time for a given factor, whether increasing or decreasing within the factor between the two surveys for both groups together. Thirdly, we look at the interaction between group mean values and time, which compares the development of a factor over time between the two groups. These three steps are done for each factor block separately. The third step is of particular relevance to our research questions.

The results from the general linear models for repeated measures indicate whether any of these comparisons are statistically significant. Table 3.1 provides the numerical values for the means in all factors for the two groups of continuers and stoppers at both surveys. It also gives the F values from the statistical analysis. The "group" value represents the magnitude of difference between groups, the "time" value represents overall change over time, and the "group*time" value stands for the interaction term between group and time point, which represents differences in progress between groups over time. If the group term is significant, there is an important difference in overall means between the groups of continuers and stoppers disregarding time. A significant time value means that the development over time of a factor is important, for instance, an important increase or decrease in the mean values occurs over time disregarding group differences. When the group*time interaction term is significant, the means for the two groups show a statistically significant difference in development over time; they progress differently.

3.3.1 Psychological factors

No significant differences exist between the groups of continuers and stoppers of drinking water treatment regarding their estimation of the risk factors vulnerability for and severity of diarrheal diseases overall. However, there is a significant development over time in the severity factor – both groups estimate the consequences of diarrheal disease as less severe at survey 2 than at survey 1. This decrease is significantly stronger for continuers, who had higher scores at survey 1 than stoppers, but lower ones at survey 2, yielding a significant interaction effect. Health knowledge of diarrheal disease was already significantly higher for continuers at survey 1 and remained higher at survey 2, and there is a general increase in both groups.

When asked for rating the taste of treated and untreated water, a clear pattern emerges between the two groups. Continuers rate the taste of treated water better at both surveys, while stoppers liked the taste of untreated water better. No significant development occurred over time. The efforts perceived necessary to treat drinking water were rated equally by the two groups at both surveys. Additionally, this attitudinal factor developed over time for both groups, which means that there is no significant difference in progress over time. While no differences existed between groups or surveys for monetary cost estimates, there was a significant difference in the perceived benefits of water treatment between the two groups and between the surveys. Continuers rated the benefits higher at both surveys, and generally this attitude evolved positively over time for both groups.

Significant differences in the perception of social norms between groups exist in almost all factors in the norm block. Continuers of water treatment think that more people engage in this behavior than stoppers, they feel a higher personal obligation to do so compared to stoppers, support from the head of household for the responsible person is higher, and water treatment is more often a topic of discourse among those households where water treatment is continuously performed at both

TABLE 3.1: Results from GLM analysis. Means of continuers and stoppers of water treatment at survey 1, survey 2, and differences in means between surveys (1 –> 2) for all psychological factors.

	continuer (N = 86)					**stopper (N = 111)**					**GLM: F-value**		
	Survey 1		**Survey 2**		**1 –> 2**	**Survey 1**		**Survey 2**		**1 –> 2**			
Factor/Survey	*Mean*	*(SD)*	*Mean*	*(SD)*	*Mean*	*Mean*	*(SD)*	*Mean*	*(SD)*	*Mean*	*group*	*time*	*g*t*
Vulnerability	2.31	1.20	2.02	0.88	-0.29	2.18	1.04	2.44	1.14	0.26	1.712	0.026	**6.42***
Severity	3.31	1.26	2.35	1.37	-0.96	3.07	1.13	2.72	1.36	-0.36	0.211	**30.182***	**6.282***
Health Knowledge	3.27	0.90	3.99	0.82	0.72	2.99	0.89	3.64	1.01	0.64	**9.576***	**65.853***	0.138
Taste treated water	4.27	0.76	4.40	0.72	0.13	3.85	0.93	3.97	0.95	0.13	**20.748***	2.441	0
Taste untreated water	2.53	1.42	2.62	1.16	0.08	3.03	1.29	3.23	1.13	0.20	**17.358***	1.328	0.232
Perceived efforts	3.87	1.18	4.55	0.77	0.69	4.07	1.15	4.36	0.86	0.29	0.004	**22.486***	3.799
Perceived costs	4.30	1.23	4.58	1.00	0.28	4.25	1.13	4.20	1.11	-0.06	3.343	0.997	2.523
Perceived benefits	4.21	0.75	4.34	0.69	0.13	3.78	0.90	4.05	0.77	0.27	**16.968***	**7.35***	0.898
Descriptive norm	2.79	1.03	2.75	0.94	-0.04	2.69	1.03	2.23	0.75	-0.46	**9.538***	**7.363***	**5.324***
Injunctive norm	2.36	1.32	2.36	1.27	0.00	2.36	1.33	2.20	1.17	-0.16	0.305	0.484	0.484
Personal norm	3.97	0.94	4.10	0.90	0.13	3.54	1.02	3.35	1.08	-0.18	**30.165***	0.091	2.76
Social Support	4.08	1.09	4.33	1.00	0.25	3.61	1.28	3.12	1.54	-0.49	**41.614***	0.802	**8.366***
Social Discours	2.76	1.40	3.44	1.44	0.69	2.37	1.41	2.18	1.23	-0.19	**33.634***	3.373	**10.461***
Action knowledge	3.37	0.81	3.56	1.00	0.19	3.32	0.92	3.34	0.95	0.03	1.567	0.453	0.149
Perceived Self-Efficacy	3.74	0.81	4.01	0.72	0.28	3.34	0.88	2.94	1.13	-0.40	**50.899***	0.625	**15.957***
Action Control	3.80	0.91	4.17	0.97	0.37	3.51	0.96	*3.31*	*1.09*	*-0.19*	***18.038****	*1.316*	***4.32****
Commitment	4.01	0.75	4.15	0.75	0.14	3.58	0.89	*3.67*	*0.75*	*0.09*	***18.923****	***6.178****	*0.965*
Habit	4.04	0.99	4.33	0.92	0.29	3.47	1.15	*3.46*	*1.06*	*-0.01*	***19.722****	*1.226*	*0.098*
Intention	3.27	1.01	3.37	1.19	0.11	2.83	1.26	1.34	1.64	-1.49	**80.738***	**29.256***	**38.837***

Note. GLM F-values, * statistically significant in bold at alpha = .0025, corrected for multiple testing according to Cohen (1988); N = 197, italics: reduced data due to missing self-regulation factors stoppers without intention at survey 2: N = 47.

surveys. Additionally, the perception of the descriptive norm decreases significantly over time for both groups. However, this is mostly due to the significantly stronger decrease for stoppers, while the perception of others' behavior remains almost unchanged for continuers.

Further significant interactions between group and time were observed for social support and social discourse. While both of these factors increase for continuers, who perceive more support in carrying out water treatment and discuss it more often than before, they decrease for stoppers, which means that social support and discussing it diminishes within this group.

A similar pattern was observed when looking at the perceived self-efficacy to engage in water treatment. While continuers already felt more confident in their abilities to perform and continue to execute the steps necessary for water treatment even when experiencing difficulties or drawbacks at survey 1, this difference had significantly increased by survey 2. Continuers felt even more self-confident, while self-confidence weakened in stoppers.

Significant differences also exist for the block of self-regulation factors. Continuers stated that they put more effort into monitoring and controlling their behavior at both surveys. While they evolve positively, action control decreases significantly for stoppers over time. Commitment to water treatment shows slight positive progress over time for both groups; however, continuers score significantly higher at both the first and the second measurements. The two groups also differ significantly in the strength of self-reported habit for water treatment. While there is no significant development over time, continuers report a much stronger habit at both surveys.

The strength of intention to treat drinking water shows some of the greatest discrepancies between continuers and stoppers at all three steps of analysis. Continuers had stronger intentions at the first survey, and while there is significant progress over time overall, continuers develop positively towards an even stronger intention, while intention decreases dramatically for stoppers from survey 1 to survey 2.

3.3.2 Additonal factors

The RANAS model takes into account a number of external (personal, social, and physical) factors that can influence behavior. Here, we investigated some other factors that possibly could distinguish continuers from stoppers. We looked at whether the study site or the setting between city and village had an influence on the proportion of people using water treatment. We further inquired the primary sources households were using to get drinking water from and whether they had switched sources between the two surveys.

However, we could not find any important differences between these external factors and the two study groups. Detailed results displaying proportions of continuers and stoppers over these factors are displayed in Table 3.2.

TABLE 3.2: Socio-demographic variables tested between behavioral groups.

Factor	Group	M	SD	F	p
Total household members	continuer	9.27	5.764	.003	.959
	stopper	9.32	6.145		
Household members under 5	continuer	2.30	1.709	.352	.554
	stopper	2.46	1.944		
Children between 5 and 17	continuer	3.27	2.584	.009	.925
	stopper	3.23	2.750		
Primary caregiver is married	continuer	0.87	0.336	.402	.527
	stopper	0.90	0.300		
Age of primary caregiver	continuer	32.21	10.137	.220	.639
	stopper	32.98	12.350		
Level of education of primary caregiver	continuer	1.10	0.795	3.597	.059
	stopper	0.87	0.825		
SES asset score	continuer	0.63	0.235	1.983	.161
	stopper	0.57	0.238		
Overall hygiene score	continuer	0.53	0.159	1.689	.200
	stopper	0.47	0.159		
Frequency of diarrheal disease among child under 5	continuer	2.49	1.225	.764	.383
	stopper	2.64	1.189		
Distance to primary water source (in m)	continuer	126.79	179.767	1.063	.304
	stopper	155.41	200.720		
Total time for a round trip to primary water source (in min)	continuer	14.05	13.364	1.610	.206
	stopper	11.90	10.110		

Note. *The level of education was set to be "0" for "no school visited", "1" basic education" and "2" "higher education". SES asset score is based on whether the household owned the following: bed, table, radio, TV, refrigerator, vehicle, cellphone, electricity; the overall hygiene score is based on a range of spot-check observations within the household (both range 0-1). Frequency of diarrheal disease among children below 5 years of age was rated between "never" – "several times a year/month/week" – "almost every day".

A total of 24 continuers and 31 stoppers had switched to another primary source from survey 1 to survey 2 (Table 3.3). However, the number of relevant changes, i.e. switching from an unimproved to an improved source or vice versa was negligible. Of the continuers, seven households switched from an unimproved to an improved source and only one household from improved to unimproved. From the stopper households, four switched from an unimproved to an improved and five from an improved to an improved source. The large majority of households switching to a different source stayed within the classification of source they had been using before.

TABLE 3.3: Additional factors. Counts and proportions within group for continuers and stoppers.

			Survey 1		Survey 2	
Factor	**Level**		**continuer**	**stopper**	**continuer**	**stopper**
setting	rural	Count	47	63		
		% within group	52.2%	51.6%		
	urban	Count	43	59		
		% within group	47.8%	48.4%		
primary water source at baseline	surface water	Count	1	6	0	2
		% within group	1.2%	5.8%	0.0%	2.0%
	street vendor	Count	7	2	3	5
		% within group	8.5%	1.9%	3.6%	5.1%
	tap water	Count	18	33	23	29
		% within group	22.0%	31.7%	27.7%	29.3%
	traditonal (dug) shallow well	Count	1	1	2	0
		% within group	1.2%	1.0%	2.4%	0.0%
	deep well pump	Count	55	62	55	63
		% within group	67.1%	59.6%	66.3%	63.6%
change of water source	no	Count			59	73
		% within group			71.1%	70.2%
	yes	Count			24	31
		% within group			28.9%	29.8%

Note. * Not all households could be classified to a unique primary source.

3.3.3 Reasons for water treatment

When asked why or why not subjects were treating their drinking water, responses were given in an open question format and later classified into several categories.

Among all subjects at survey 1, reasons for water treatment mentioned were Rto kill germs" (mentioned by 122 interviewees or 61.9%), "to avoid disease" (118; 59.9%), "to make water safe" (38; 19.8%), "stay healthy" (27; 13.7%), to "reduce the risk of diarrhea or cholera" (19; 9,6% or 16; 8.1%), and others (2; 1%). The same categories of reasons were mentioned in about the same proportions at survey 2 by those still continuing water treatment.

Stoppers at survey 2 mentioned several reasons for not treating drinking water anymore. Among those were "lack of material" (52; 46.8%), "lack of financial means" (40; 36%), others thought that "the water was already safe" (16; 14.4%) or simply thought of it as "not a habit" (7; 6.3%). Other reasons for not treating water were not knowing "how much chlorine to put in", the responsible person in the household was away travelling (both mentioned once).

3.4 Discussion

In this study, we investigated the role of psychological factors in the continuation of drinking water treatment. To do this, we compared individual subjects in households where drinking water treatment was continued from one survey to a later one with similar individuals in households where treatment had stopped in the meantime. Based on a number of behavior factors from health psychology, we show how these two groups' mindsets differ from each other and evolve differently over time. In doing so, we tried to identify factors which are relevant to the continuation of drinking water treatment. We looked at a) which factors differed initially between the two groups, b) which factors change over time between the two surveys, and c) which ones evolve differently over time for the groups of continuers and stoppers.

Generally, it was observed that continuers of drinking water treatment display higher scores on the majority of psychological factors related to treatment behavior (except in the rating of taste of untreated water, which was higher for stoppers, as one might expect). This is true for results from the initial baseline survey at survey 1. In accordance with findings from similar studies and health psychology, this shows that important differences exist in the mindsets of people, and that these can be more or less predictive of how likely it is that they adopt such health-protective behaviors as handwashing, water treatment, and the use of adequate sanitation (Huber & Mosler, 2013; Inauen, Tobias, & Mosler, 2013a; Kraemer & Mosler, 2011; Mosler, Blöchliger, & Inauen, 2010; Sonego & Mosler, 2014; Stocker & Mosler, 2015; Tamas, Meyer, & Mosler, 2013).

In addition to the initial differences, we find a number of these to be even more pronounced at the follow-up measure at survey 2, with some exceptions that shall be addressed later on, which means that there is a different evolution of factors over time between the two groups of subjects. This is especially the case for health knowledge, taste of treated water, perceived efforts related to water treatment, most of the normative factors such as descriptive and personal norms, social support, social discourse, action control from the self-regulation block, intention, commitment to water treatment, and related habits. Significant differences occur in the development of factors over time between the two groups. This was particularly the case for three of the normative factors, namely descriptive norm, social support, and social discourse. It was also so for perceived self-efficacy, intention for water treatment, and to some degree for action control. Generally, the pattern was that these factors evolved positively for continuers of water treatment, who displayed increased values at survey 2 compared to survey 1. This means that those subjects whose households continued to treat their drinking water from survey 1 to survey 2 developed a more positive mindset for drinking water treatment than their initial baseline values.

Continuers developed stronger social norms in favor of household water treatment. In particular, they had a stronger impression that more of their neighbors, close relatives, and friends engaged in water treatment, received more support from other household members, and talked about it more often than at survey 1. The same subjects also became more self-confident in their abilities to perform water treatment generally, uphold their behavior despite arising difficulties, and recover from drawbacks. This is in accordance with health psychology literature, where self-efficacy is said to be one of the most important drivers of behavior in all stages of behavioral execution (Schwarzer, 2008; Bandura, 1991). In behavioral models that separate health behaviors into different stages (e.g. contemplation, intention building, behavioral execution, and maintenance of the behavior) having enough confidence has an important influence on whether or not the behavior is executed or upheld at every stage. Continuers also spent more energy monitoring their own actions, which is another important factor for behavioral maintenance found in the literature (Rothman et al., 2004). The intention to perform and to continue performing water treatment also intensified over time for continuers compared both to initial intentions and to those subjects who stopped doing so. This is in line with findings that the intention to engage in a certain behavior is already a proximate measure for the behavioral execution itself (Ajzen, 1985).

In contrast, stoppers can be characterized by a decrease in several factors. Subjects who stopped water treatment from survey 1 to survey 2 showed a decrease in all normative factors, which means they came to perceive the behavior as less common and desirable, felt less personally obliged, received less support from their family members, and talked about the topic less often. Stoppers also became less

confident in their abilities to always perform water treatment and spent less effort in monitoring their own actions; for instance, they reminded themselves about it less often. The strongest drop in all the factors analyzed was in their intention to perform water treatment, which corresponds closely with the change in behavior from treatment to no treatment.

A somewhat paradoxical finding is that of a reversed time trend for two risk factors, vulnerability and severity. In both, continuers of drinking water treatment scored lower on the scale than stoppers after starting from about the same baseline value. This is contrary to the general hypothesis that assumes continuers also develop higher values in these constructs, as we generally see higher values to be of positive predictive value for the target behavior. This means we would expect to find that sustainable users of water treatment have stronger fears of contracting diarrhea and its consequences, which would in turn foster their efforts to engage in protective actions.

However, it makes equal sense for subjects showing more protective behavior to feel less vulnerable to threats. This would mean a reversed causality from that described above. People who continue to treat their drinking water need fear diseases transmitted by their water less, and thus their perceived risk estimates are lower than those of people who do not protect themselves. When asked to rate the severity of consequences of diarrheal diseases, people might be responding to their actual experiences. Again, people engaging in protective behavior should be less susceptible to disease, experience fewer or milder cases, and subsequently rate the impacts on their lives as less severe. This finding is in line with the results of similar studies (Huber & Mosler, 2013).

General increases over time were observed in some other factors, such as health knowledge, perceived efforts and benefits, and commitment, but without statistically significant differences in progress between continuers and stoppers. For these factors, it might be the case that there is a general, naturally occurring evolution, with people becoming more familiar with knowledge of disease and prevention. Perhaps other promotion activities took place in the same period as this study that we were not aware of. In addition, being subject to a survey and answering questions related to one's own health and health behaviors can also be seen as an intervention in itself and can lead to reconsideration of one's own standpoints and behaviors (Thevos, Quick, & Yanduli, 2000). This is also why a control group is usually crucial to the critical evaluation of behavior change programs.

In sum, the psychological factors most important for the continuation of water treatment are perceived others' behavior, social support between family members, social discourse, positive self-efficacy convictions, and strong intentions in its favor. Additionally, monitoring one's own actions also seems to be an important factor for continued water treatment. These factors best discriminate between continuers and stoppers of drinking water treatment at the household level and should be considered when promoting sustainable behavior change towards drinking water treatment at the household level.

When comparing these results with the answers to the open question about reasons not to treat drinking water from the second survey, interestingly, the two most frequent ones mentioned by almost half of all stoppers were "lack of material" and "lack of financial means". We would expect this reasoning to be reflected in the results for psychological factors. Although the perceived costs for water treatment per se are reported to be very low to low by both groups with no significant differences between group and over time, we can interpret both of these reasons to be reflected rather within the perceived self-efficacy. Chlorine products are widely available in

the country and can even be found in small boutiques on the village level. This means that it is not necessarily actually difficult to get the material or pay for it, but it might rather be a problem of lacking confidence in being able to save and invest the money for it and remind oneself to go and purchase the product.

A number of additional factors external to the person questioned in the interview were examined regarding their possible influence to distinguish between the two user groups, but no important differences were found. On the other hand, the aim of this work is not to explain why some people stop while others continue treating their drinking water. The focus is rather on exploring differences in the psychological mindsets between the two groups to generate ideas on how to support households in maintaining their current (positive) health behavior.

Based on these findings, we conclude that several psychosocial factors play a distinct role in the continuation of drinking water treatment. Factors that should be addressed with emphasis once people have adopted the desired behavior are the perception of social norms, especially the perception of others' behavior, social support for and discourse about the topic of water treatment, strong intentions and beliefs in one's own capacity to perform treatment, and monitoring one's own actions.

For practitioners in the field, these findings can be of very useful in developing promotion activities that strengthen these factors and so foster sustainable behavior change. Highlighting existing social norms, especially the extent to which water treatment is perceived as common within a local community, could help motivate people to maintain drinking water treatment over time. Additionally, emphasizing mutual support mechanisms and encouraging public dialogue on the topic appear to be promising strategies. Providing how-to-do knowledge, facilitating resources, and demonstration or guided practice can help to strengthen peoples' beliefs in their own capacity. Additionally, prompting self-monitoring, for instance by providing memory aids and giving feedback on current performance, could help to prevent subjects from stopping and thus maintain the behavior.

When considering the stages of behavior change discussed in the literature, it might also be useful to assess what level of behavior different individuals are at and how firmly the target behavior is already established within a population. Factors might play roles of differing importance depending upon whether fewer or more people have already adopted a new behavior, and different behavior change techniques should be used for different user groups as identified here The present findings can also help to define long-term goals for sustainability with which programs can be evaluated beyond simply measuring the adoption of behavior.

One major weakness of continuum models is that they do not discriminate between different stages of behavior and thus usually account better for variance in intention and less in actual behavior (Schwarzer, 2008). Based on the critique of this gap between behavioral intention and actual behavior, a number of factors have been identified that play a stronger role once intention is already built up and the question is whether a behavior is not only intended or tried but maintained over time. These factors can be mostly accounted for by the self-regulation block and are more distinctively covered in e.g. the Transtheoretical Model of Behavior Change (Arbuckle & Diclemente, 1986). In this sense, one could expect to find larger differences in the psychological factors from the self-regulation block. Next to the important differences between continuers and stoppers of water treatment that are present in some of the norm factors, this actually seems to be the case with consistently strong effect for self-efficacy perceptions, action control, commitment, and habit.

To some extent, focusing too much on the factors for initial adoption might also actually decrease the motivation of already users and thus continuation of behaviors. As has been shown, initiation of behaviors is more often motivated by expectancies of benefits, while the motivation for continuation is measured regarding the actual satisfaction of reaching the expectations (Rothman et al., 2004). This highlights the importance of carving out what factors are distinctively important for behavioral continuation compared to initiation. Such findings might support the usage of stage models that differentiate between non-users, new adopters, and long-term users and to know what is necessary to support these different groups in their behavioral motivations respectively.

There are several limitations to this study that should be mentioned. Self-reported behavior is always subject to diverse mechanisms of bias (Biran et al., 2008; Manun'Ebo et al., 1997; Stanton, Clemens, Aziz, & Rahman, 1987). These can happen involuntarily or unconsciously but may also be based on deliberate false information from the subject (Contzen, De Pasquale, & Mosler, 2015). Involuntary biases are based on well-studied cognitive processes which are usually not accessible to the respondent, such as recall errors and other memory effects (Kahneman, 2011) and the reduction of cognitive dissonance (Festinger, 1962), which can lead to a distortion of information. On the other hand, information is also often intentionally falsified for different purposes. This can be the case when people hope to benefit from giving specific answers, especially in a campaign program or other circumstances in which answers tailored to meet expectations or appear socially desirable (Furnham, 1986). While other methods exist to measure behavior, these bear other disadvantages. For example, direct observations may be more valid, but these are usually much more expensive and time-consuming than self-report (Ram et al., 2011). Residual chlorine was not tested in households in both surveys. Results from residual chlorine testing at survey 2 suggest a much lower actual rate of water treatment than what we would assume from the self-reported data would. This is what can be expected when asking people on possibly socially desired health behaviors such as in the WASH sector (Curtis, Cousens, et al., 1993).

The problem of bias in self-reported data has been addressed for once in the design of this study. While we expect some of the mechanisms mentioned above to influence the data, these effects should be the same for all subjects under study here. By comparing different groups from the same sample, interviewed with the same instruments, we assume problems of bias to be largely eliminated.

Further, it has been shown that successful interventions in changing behavior can be designed on the basis of self-reported behavioral data (Inauen & Mosler, 2013; Kraemer & Mosler, 2012; Tumwebaze & Mosler, 2015; Contzen, Meili, & Mosler, 2014; Huber et al., 2014). It might not be relevant after all to measure exact behavior and to validate self-reports about it when we can still explain what factors differentiate between users and non-users of technologies or groups of high and low performers of relevant health behaviors.

Another difficulty exists in measuring self-regulation factors in people currently not engaged in the behavior under study. More specifically, stoppers who stated no intention to treat their drinking water at survey 2 could not answer most of the factors from this last block. It seems infeasible for them to give information on the effort they currently put into monitoring a behavior they do not show, remembering to carry it out, or planning what to do in the case of relapses. The same is true for the strength of commitment or questions about current habits, which were repeatedly

not understood or simply not answered at all by stoppers without intention at survey 2. However, while no information exists for self-regulation factors in these subjects, the related questions could still be answered in a hypothetical way by stoppers who at least reported some intention to treat water. The study size is therefore reduced for the self-regulation block, and corresponding results should be interpreted with caution. Even though one could assume that these factors would be rather low for the stoppers at survey 2, we did not try to estimate or impute values for this group. However, we can infer the effects of these factors to be underestimated, since the subjects with the potentially lowest values are no longer represented in the results. The problem of measuring self-regulation in subjects not engaged in a behavior should be given more attention in future research these factors are of particular interest for the continuation of health behaviors (Rothman et al., 2004).

Ideally, the level of behavioral execution together with psycho-social factors would be measured repeatedly over a period in a multi-survey study. This would allow a much more detailed investigation of the mechanism underlying behavioral continuation, especially the change between the stages of behavior change from adoption to continuation to habit formation proposed in the literature (Weinstein, Lyon, Sandman, & Cuite, 1998). The present study only offers two surveys with a period of almost two years between them, possibly subject to a range of personal or general extraneous influences. It therefore only serves as an approximate examination of some mechanisms for behavioral continuation. For future research, we thus propose to follow a possibly smaller sample size over time in a more tight-knitted survey study to understand better how long subjects have been treating their drinking water, exactly when and for what reasons they stop or why they would possibly also restart doing so.

3.4.1 Conclusions

The mindsets of groups of people who continued or stopped treating drinking water in their households have been compared regarding their mindsets concerning this behavior. Individual psychosocial factors involving social norms, perceived self-efficacy for continuation, action control mechanisms, and intention to maintain the behavior have been identified as important factors distinguishing individuals in households where drinking water treatment is continued from those where this had stopped. Focusing on these factors might improve promotion strategies and the definition of evaluation criteria and thus enhance programs targeting sustainable behavior change. However, a more detailed approach is suggested to the study of underlying psychosocial factors for behavioral continuation and possibly the use of stage models.

Chapter 4

Effects of a behavior change campaign on household drinking water disinfection in the Lake Chad basin using the RANAS approach

Authors: Jonathan Lilje and Hans–Joachim Mosler [1]

Abstract

Worldwide, an estimated 700 million people rely on unimproved drinking water sources; even more consume water that is not safe to drink. Inadequate drinking water quality constitutes a major risk factor for cholera and other diarrheal diseases around the globe, especially for young children in developing countries. Household water treatment and safe storage systems represent an intermediate solution for settings that lack infrastructure supplying safe drinking water. However, the correct and consistent usage of such treatment technologies rely almost exclusively on the consumer's behavior.

This study targeted at evaluating effects of a behavior change campaign promoting the uptake of household drinking water chlorination in communities along the Chari and Logone rivers in Chad. The campaign was based on formative research using health psychological theory and targeted several behavioral factors identified as relevant. A total of 220 primary caregivers were interviewed concerning their household water treatment practices and mindset related to water treatment six months after the campaign. The Risks, Attitudes, Norms, Abilities, and Self-regulation (RANAS) model was used to structure the interviews as the RANAS approach had been used for designing the campaign.

Results show significantly higher self-reported drinking water chlorination among participants of the intervention. Significant differences from a control group were identified regarding several behavioral factors. Mediation analysis revealed that the intervention positively affected participants' individual risk estimation for diarrheal disease, health knowledge, perceived efforts and benefits of water treatment, social support strategies, knowledge of how to perform chlorination, and perceived ability

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to do so. The campaign's effect on water treatment was mainly mediated through differences in health knowledge, changes in norms, and self-efficacy convictions.

The findings imply that water treatment behavior can be successfully promoted using health psychological theory. However, they also indicate opportunities for improvement in the campaign design and implementation.

4.1 Introduction

Drinking water quality is still one of the primary foci of development work in many countries across the globe. Providing access to safe drinking water has been a development goal of the United Nations Assembly since their first Conference on Environment and Development in Rio de Janeiro in 1992 (UN, 2010). Inadequate drinking water is one of the leading causes of diarrheal diseases in developing countries and constitutes a major cause of mortality in children below the age of 5 years (Robert E Black et al., 2010; Prüss-Ustün et al., 2014). Worldwide, an estimated 700 million people rely on unimproved drinking water sources, and even more consume water that is not safe to drink (Bain, Cronk, Hossain, et al., 2014; Onda et al., 2012; WHO/UNICEF, 2015). According to the latest Joint Monitoring Program (JMP) figures for Chad, only 51% of the population has access to improved drinking water sources (JMP, 2015). This means that at least around half of the country's population consume water that is not safe for drinking unless it undergoes some treatment process at the household level, leading to possibly even higher rates of people consuming contaminated water. Further, large discrepancies exist between urban areas and rural communities, where the rate is usually significantly lower.

Where adequate infrastructure is lacking, household water treatment and safe storage systems (HWTSs) constitute an intermediate alternative (Clasen, Schmidt, et al., 2007). Existing technologies include solar water disinfection (SODIS), filtration, and chemical disinfection (e.g. using chlorine). However, all of these options require some action to be taken by the consumer at the personal or household level. As with other health-relevant behaviors, the decision to adopt one such technology depends on social, physical, and personal contextual factors (Dreibelbis et al., 2013; Mosler & Contzen, 2016). The social context comprises the cultural norms and economic and legal conditions, the physical context consists of the natural and built environment, and the personal context includes socio-economic factors such as age, sex, and wealth. Health psychology theory can be used to explore and understand consumers' decision making regarding health–relevant behaviors such as household water treatment by considering a range of intra– and inter–individual factors (Contzen & Mosler, 2015; Kraemer & Mosler, 2011; Mosler, 2012). These factors can help to understand why people engage in particular health behaviors or not; they can ultimately be used to develop effective behavior change strategies (Contzen & Mosler, 2015; Contzen, Meili, & Mosler, 2014; Huber et al., 2014; Inauen & Mosler, 2013; Kraemer & Mosler, 2012; Mosler, Kraemer, & Johnston, 2013; Tamas, Mosler, & Gutscher, 2009; Tumwebaze & Mosler, 2015). The Risk, Attitude, Norms, Ability, Self-regulation (RANAS) model comprises an extensive collection of psychological factors from various theoretical models and arranges them into five distinct blocks (Mosler, 2012).

Risk factors include the individual's perception of his or her own risk of contracting a disease together with an estimation of its consequences. Health knowledge is knowledge about the relation between particular behaviors and their effects on the risk of contracting disease. Attitude factors comprise a person's feelings and

subjective rating of the costs and benefits of a behavior, its preconditions, and its consequences. Norm factors describe how others' behavior is perceived, the extent to which a behavior is approved of or disapproved of by important others, and the subjective importance given to a behavior. Ability factors are about the how–to–do knowledge of a behavior: they concern a person's perceived abilities and planning capacities for commencing and continuing a behavior and for recovering from setbacks. Self–regulation factors comprise self-monitoring strategies: evaluating and reacting to one's own current behavior. This includes reminding oneself of one's intentions, coping with barriers and difficulties arising, and finally establishing a habit. The RANAS model was conceived specifically for application in development contexts and has been shown to be useful in developing successful intervention strategies for the promotion of health-relevant behaviors across the water, sanitation, and hygiene (WaSH) sector (Contzen, Meili, & Mosler, 2014; Inauen & Mosler, 2013; Tumwebaze & Mosler, 2015).

Cholera is still one of the most serious diarrheal diseases, with fluctuating case numbers around the globe possibly underrated and under–reported (Zuckerman, Rombo, & Fisch, 2007). In 2015, 42 countries reported 172,454 cases and 1304 cholera-related deaths, with most cases and deaths occurring in African countries (WHO, 2016). The number of cholera cases rose to over 60,000 in 2010 and 2011 together for Chad and Cameroon alone. These two countries share the Lake Chad Basin with Nigeria and Niger; the Basin is a hotspot that is frequently hit by cholera outbreaks that quickly spread across the region's porous borders. Weak health infrastructure, many remote areas with difficult access, and political instability also combine to beset this region with heavy cholera epidemics (Jutla et al., 2013; Naidoo & Patric, 2002). Consequently, the governments of Chad and Cameroon and the World Health Organization (WHO) are trying to establish a strategy of quick response and prevention for cholera and other diarrheal diseases in the region (MSP, 2013). As part of this strategy, a campaign was developed and implemented at the household level to promote drinking water disinfection using chlorine in several communities along the Chari and Logone river beds.

4.1.1 Research questions

The objectives of this evaluation study were to examine the effects of the interventions on participants' water treatment behavior and changes in their psychological mindset concerning the target behavior. The following research questions were addressed:

- Did the campaign have a positive impact on water treatment among intervention participants?
- Did the campaign affect psychological factors for drinking water treatment that were targeted by the campaign?
- Which of these psychological factors mediated the effects of the campaign on behavior?

4.2 Methods

4.2.1 Description of the campaign

Interventions consisted of community meetings organized by the local health care centers in each study community. The sessions were led by a pair of promoters trained at a two–day workshop prior to the intervention. The intervention roll-out was supervised by the principal of the health care facility. Regular monitoring visits were made by the partnering NGO, Centre de Support en Santé Internationale (CSSI), who had also organized the training. During the first sessions, promoters were assisted, and feedback was given on their performance after the session. Later, the visits served to monitor correct implementation, usage of materials, and collection of participant lists.

In each community, a total of eight to twelve one–hour sessions were held during the period from November to December 2015. Meetings were organized in public buildings such as schools or town halls, and contents were repeated so that each session delivered the complete information and materials. The intervention design and manuals for promoters were conceptualized by Eawag, in collaboration with CSSI, the WHO country office, and the Ministry of Public Health in Chad. Detailed information on the intervention manual and materials is available upon request from the first author (in French).

The intervention strategies were informed by a formative baseline study in December 2013 and May 2014 among 1016 primary caregivers of children under the age of five years (Lilje, Kessely, & Mosler, 2015). These surveys identified the psychological factors relevant to household water treatment, which were then recommended as the targets of promotional efforts to increase the uptake of water chlorination. Interventions were developed specifically targeting those psychological factors identified in the baseline study with the aim to promote the uptake of drinking water chlorination. This evaluation survey was conducted in a subsample of intervention participants in July 2016.

Intervention sessions were organized around four elements implementing several behavior change techniques (BCTs) as described in Contzen and Mosler 2016; these were chosen based on the findings of the baseline survey (Lilje, Kessely, & Mosler, 2015). All four elements were presented to the participants during each intervention session in the order presented below.

The first element was a pre-recorded audio advert which introduced several arguments and personal statements about water treatment. These statements were inspired by interview responses given during the baseline surveys. The script was then refined to cover various aspects of water disinfection, such as how-to-do knowledge, vulnerability, perceived costs and benefits, abilities, and social norms concerning water treatment. Several BCTs were incorporated in this recording, such as "Inform about personal risk" (BCT 3), "Inform about and assess costs and benefits" (BCT 5), "Provide instruction" (BCT 15) targeting risk, attitude, ability, and norm factors. The statements in the recording were mixed so that positive stances outweighed negative stances. This fed the impression that more people were engaged in the behavior than those who were not and served as a means to target the perception of others' behavior and others' approval ("Inform about others' behavior", BCT 9; "Inform about others' approval/disapproval", BCT 11). Below is an exemplary statement played during the audio recording targeting perceived costs and benefits (BCT 5, translated from French).

> *"I went to buy « eau de javel » (liquid chlorine solution) at the local market, the price is about the same as for a pack of salt or sugar and it serves to treat the drinking water for our family for a whole month. Some people say it is too expensive or that they don't have the money for that. But if you think about the costs to buy medication each time when your kids fall sick, it is actually not that much money"*

The recording was provided to promoters as an MP3 file on a memory card together with a playback device and batteries. It was played to participants at the beginning of the intervention sessions. The advert was conceived in collaboration with a local radio station, spoken by professional actors, and recorded in three different languages, French, Arabic, and Sara.

The second element was a poster communicating information on where and how diarrhea is contracted and what can be done to prevent it. It was an adaptation of the F–diagram (Cluster, 2011), which graphically depicts several pathways of diarrhea propagation and how those pathways can be interrupted. The poster used BCT 1 ("Present facts"), targeting health knowledge and explaining to participants where and why they are at risk. The main target behavior of the campaign, drinking water disinfection, was introduced as a means of protecting oneself and one's family from diarrheal disease including cholera on the poster. Participants were encouraged to discuss the contents of the poster among them to spark social discourse on the topic (BCT 7:"Prompt to talk to others").

The third element was a practical demonstration mainly targeting how–to–do knowledge ("Provide instruction", BCT 15) and confidence in performance ("Demonstrate and model behavior", BCT 17). Promoters demonstrated to participants how to correctly apply chlorine products for drinking water disinfection, including how to calculate the dosage needed. Other practical aspects were also discussed, such as where to buy chlorine, how to store and use the products safely, and what kind of locally available containers could be used for measuring quantities.

The fourth element, which concluded each session, was a public commitment appeal (BCT 10: "Prompt public commitment"). Participants were encouraged to make a public pledge in front of the assembled audience to treat their household's drinking water after having learnt the practical skills necessary. Heads of households were prompted to supply material and funds to the person responsible for the provision of drinking water within the household. Caregivers who were not heads of households were prompted to seek support from their heads of household (BCT 21: "Organize social support"). Participants committing to treating their household's drinking water received a commitment sign. This was a piece of blue cloth to be displayed on the participant's house. The sign had two main functions. One was to publicly communicate their engagement to their neighbors, visitors, and passers-by, thus highlighting the descriptive norm. The second function of the sign was to remind the members of the household about their commitment (BCT 34: "Use memory aids and environmental prompts").

4.2.2 Respondents and procedure

A total of 220 subjects were interviewed in a cross-sectional survey of five communities that had received the interventions starting in November/December 2015, and ending about six months prior to the survey. Respondents were selected randomly from the lists that had been collected from promoters during monitoring visits. A team of five local interviewers was recruited and trained extensively in preparation

for the survey. All questionnaire items and key terms were rehearsed to ensure common understanding and application of the survey tools. All interviewers were able to speak both Arabic and French as well as local languages for communication during interviews.

4.2.3 Measures

An assisted, structured interview was conducted with all respondents to assess their current water treatment practices, including questions on psychological factors concerning water treatment and a section on participation in the intervention activities. All dimensions of the RANAS model were covered by at least one item. The main points of interest here are current water treatment practice and subjects' psychological mindsets around water treatment according to the RANAS model. Respondents were asked whether they currently did anything to ensure the quality of drinking water within their household, and if yes, what exactly they did. Current water treatment behavior using chlorination was then coded as either "yes" or "no".

Questionnaire items assessing psychological factors gathered responses in Likert–scale format. Factors were uniformly scaled and recoded for analysis to a five-point scale with 1 as the minimum and 5 as the maximum. Higher values represent more positive attitudes towards water treatment (e.g. higher perceived benefits, but lower perceived difficulties). A definition of factors and exemplary items with scale reliability can be found in Table 1.1. Note that self–regulation factors were not included in the analysis, as these are usually difficult to answer for subjects who are not or have never been engaged in a behavior.

4.2.4 Data analysis

Two types of analysis were conducted, analysis of variance testing (ANOVA) and mediation analysis. To answer whether differences in water treatment behavior existed between participants of the interventions and respondents in the control condition, we compared the two groups against each other. An ANOVA was run to assess differences in water treatment between intervention participants and non-participants (research question 1). To examine which of the targeted factors were positively affected by the intervention (research question 2) and to test which of the psychological factors played a role in mediating the effect of the intervention on behavior (research question 3), simple mediation models were computed for all factors using the factors as intermediate variables between intervention and behavioral outcome.

Mediation models help to test in how far the relationship between and a dependent variable Y (the target behavior) and some independent variable X (the intervention) is influenced or mediated by an intermediate, third variable or mediator M (psychosocial factors)(see Figure 4.1). Path "a" in mediation model represents the effect of X on M, while path "b" represents the effect of M on Y partialling out the direct effect of X on Y. In contrast to this direct effect of X on Y, the indirect effect of X on Y through M is called mediation effect and is represented by the product of paths "axb". Indirect and direct effects together sum up to the total effect or influence of X on Y.

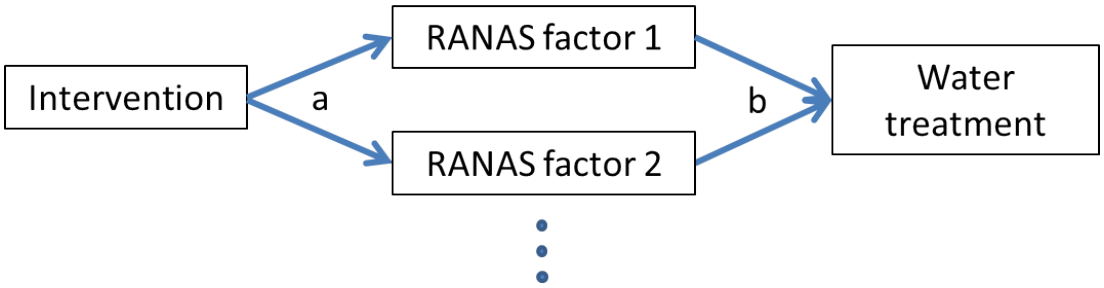

FIGURE 4.1: Template of a mediation model representing the influence of some independent variable X (intervention) on a dependent variable Y (water treatment) mediated through some intermediate variables M (psychosocial factors according to the RANAS model). Arrows from X to M represent paths "a", arrows from M to Y paths "b", while the indirect effect is the product of axb.

4.3 Results

4.3.1 Campaign participation and recall

162 of the interviewed caregivers confirmed having visited at least one session and remembered information received on household water treatment; these are therefore treated as the intervention group in the analysis. Recall of intervention elements and materials was good, with 95% of intervention participants remembering the poster, the demonstration session, and the public commitment element, while the audio recording was recalled only by 83% of participants. Fifty–eight other interviewed subjects either did not confirm their participation in any intervention activities or only visited activities concerning other health topics which took place at the same time but were not related to water treatment. This group serves as the control group in the analysis. The majority of respondents were female caregivers (85%) with 33 years of age on average. Of all respondents, 74% were able to read and write and 75% had at least an elementary school level education. Some differences in socio-economic variables existed between groups. Intervention group respondents lived in smaller households, were on average less literate, and had a lower level of education than respondents from the control group, but were equal on all other socio-economic variables such as age and household wealth (see Table 4.1)

4.3.2 Water treatment

Water treatment behaviour differed significantly between intervention participants and control group subjects. Having attended one or several of the intervention sessions had a net positive effect on participants' chlorination behavior; Respondents who had participated in at least one intervention session reported significantly higher rates of water treatment in their households than non–participating respondents. While 64% of intervention participants currently treated their drinking water, the rate among non–intervention respondents was 42% ($F = 8.157$; $p = .005$).

4.3.3 Mechanisms of the campaign

A number of the targeted psychological factors were significantly affected by the intervention (drawn a–paths in mediation model, see Figure 4.2), hence leading to differences between intervention participants and non-intervention respondents in

these factors. Interventions heightened the perception of subjective vulnerability, perceived severity, health knowledge, perceived benefits, the descriptive norm, social support, action knowledge, and self-efficacy. Unexpectedly it also heightened the perception of efforts necessary for and difficulty of treating water.

This means that participants of the intervention felt more vulnerable to and rated the consequences of diarrheal diseases as more severe, and also had a better understanding of the association between drinking water and disease. Further they thought more positive about the effects of water treatment, and rated the social norms towards water treatment as more favorable, and received more support within their families in their efforts for safe water. These subjects further knew better about how to perform water treatment and also felt more able to do so.

Secondly, factors which positively influenced the likelihood of subjects for water treatment (drawn b-paths in the mediation model, see Figure 4.2) were health knowledge, taste of treated water, perceived costs, descriptive, injunctive, and personal norms, social support and social discourse, action knowledge, and self–efficacy.

This means that the better people know about the link between water and health, the better they like the taste of chlorinated water, and the less expensive they think it is to treat their drinking water, the more likely they are engaging in this behavior. Also the more one thinks that others are engaged as well and that others think treating water is something one should do, the better people know how to do it, and the more confident they feel in doing so raises the probability that they are actually doing it. Perceived vulnerability and severity negatively influenced the likelihood of treatment behavior. People who feel more vulnerable to diarrheal disease and the more severe they think these are for their health are less likely treating their water.

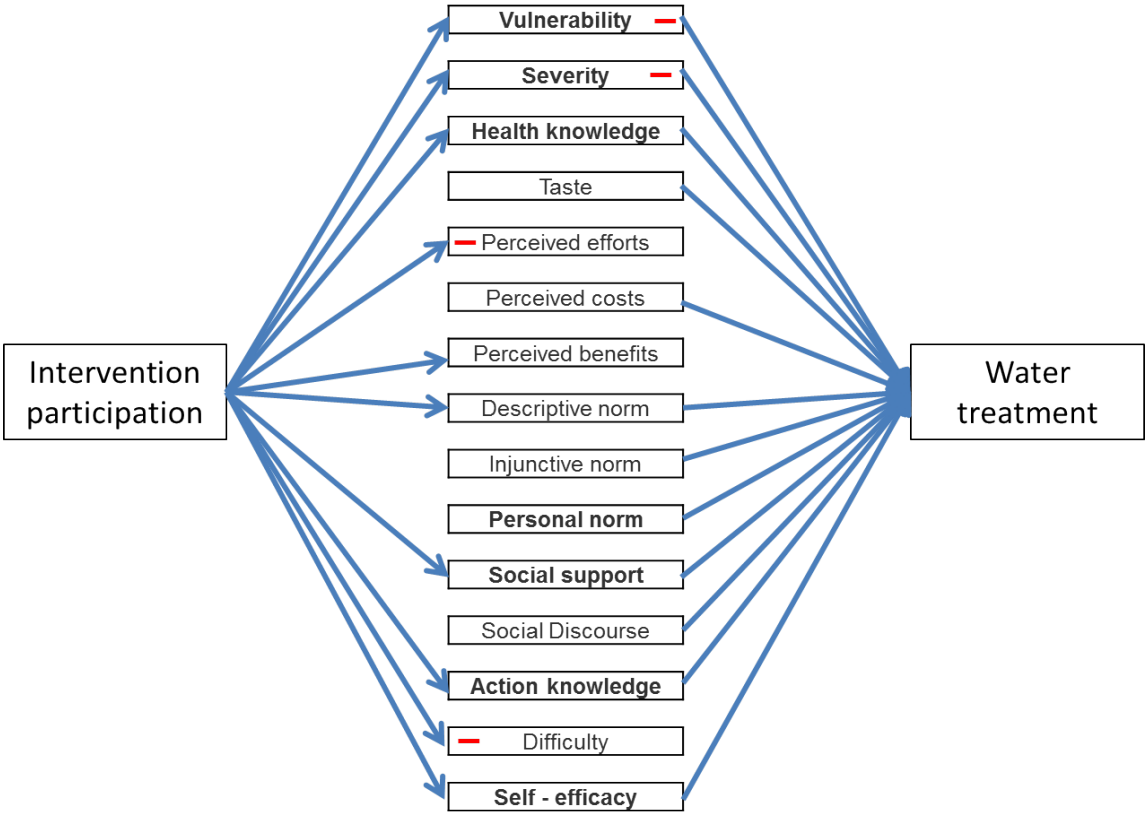

FIGURE 4.2: Mediation analysis on the effect of intervention participation on water treatment behavior through psychological factors.

When looking at which factors mediated the effects of the campaign on the behavioral outcome (axb path in the mediation analysis, see Table 4.2), not all of the factors mentioned above played a role. Health knowledge, personal norm, social support, action knowledge, and self-efficacy had significant positive indirect effects on treatment behavior. This means that by positively influencing these factors in intervention participants' mindsets, the campaign had an impact on these people's water treatment behavior. Vulnerability and severity had negative indirect effects on water treatment. This means that higher perceived vulnerability and severity are associated with less water treatment. This could be due, however, to a reversed causality which will be discussed in the next section. In sum, the intervention had a positive effect on the target behavior, mediated through changes in several of the targeted psychological variables.

4.4 Discussion

4.4.1 Summary of findings

The objective of this study was to evaluate the effects of a campaign promoting household drinking water chlorination in communities in the Lake Chad Basin. We were interested in which psychological factors were affected by the intervention and in the extent to which these contributed to the effect of the campaign on the target behavior.

Effects on water treatment

The campaign interventions had a positive effect on water treatment at time of the evaluation survey with participants reporting significantly higher chlorination rates than control group subjects.

The chlorination rates were also found to be higher compared to an earlier baseline study, when this figure had only been around 30% (Lilje, Kessely, & Mosler, 2015). Interestingly, the proportion of water treatment users had been equally low across two surveys of the baseline study which were conducted six months apart capturing behavior in two seasons of the year. The months between November and April, when the first part of the survey was conducted, represent the dry season, while the second part was completed during the rainy season, which lasts from May to October. The risk of cholera epidemics is described as increasing sharply with the onset of the rainy season (Jutla et al., 2013); however, no such a behavioral response could be observed in these samples.

Higher rates of chlorination users were also found in respondents who did not participate in any intervention activities but still live within the communities where interventions took place, but to a weaker extent. This is likely a spill–over effect of the interventions on people who live in the communities but did not actively participate in the interventions. A possible explanation is that the intervention contents were communicated between family members, neighbors, and friends. Two facts support this explanation. Firstly, many elements of the interventions targeted social norms and the perception of other people's behavior. Participants were encouraged to talk about health issues and the topic of water treatment as a means of protection against diarrheal disease. They were also encouraged to publicly commit to water treatment. Committed participants were given a sign to be displayed outside their houses. This sign serves as a reminder to themselves, but it also publicly displays this household's commitment to water treatment. Passers–by not yet aware of the

interventions might have been encouraged to ask about the meaning of these signs appearing across their neighborhood. A second piece of evidence for the spill-over effect is the fact that, together with the descriptive norm, social discourse, the extent to which water treatment is a topic of discussion among people, was one of the strongest indicators for water treatment in the baseline study (Lilje, Kessely, & Mosler, 2015). Higher chlorination rates among control subjects could also be due to the group distinction criteria, which were not as sharp as in a perfectly controlled experiment. "Control" group participants were those who could did not confirm their participation in or did not remember any of the elements of the intervention. Thus there could possibly be subjects in the control group who have participated but had forgotten about it, or that another family member might have been there and passed on the information, but not themselves.

Further, interventions had a positive effect on a range of the psychological factors targeted by the behavior change interventions. Intervention participants appeared to be more aware of their personal health risk and consequences of diarrheal diseases and had more health knowledge than control subjects. Participants also had a more positive attitude towards water treatment; they rated the benefits of treating drinking water as higher than non-participating respondents did. People who had visited the interventions thought of water treatment as more common in their community and provided or received more social support to or from other family members in treating water. Participants showed more knowledge of how to perform water treatment based on a knowledge test and had more confidence in their own abilities after visiting the intervention sessions.

Factors mediating intervention effects

The positive effect of the intervention on water treatment behavior was mediated through better health knowledge of intervention participants, increased personal importance and more social support from other household members, better knowledge about how to perform water treatment, and an increased belief in their own abilities to do so. These findings show how the various elements of the intervention acted to foster the uptake of chlorination practice among participating households by using suitable BCTs tailored to specific psychosocial factors. In addition, perceived benefits and the descriptive norm also had a positive indirect effect on treatment behavior, although only borderline significant; this revealed their potential contribution in mediating the intervention effects.

However, not all of the targeted factors steering treatment behavior were influenced in the intended way. Contrary to expectations, interventions did not significantly influence the perceived cost of chlorination, injunctive or personal norms for water treatment, nor social discourse, all of which also steer behavior.

Also, intervention participants thought of water treatment as more difficult and needing more efforts than non-participating respondents did. It might be that they only realized what it takes to continuously perform water treatment after visiting the interventions and starting to perform water treatment in their households, although the intervention elements were designed to show treatment as easy and uncomplicated. This finding contradicts the argument that HWTSs are affordable and easy-to-use solution to safe drinking water (Clasen, Schmidt, et al., 2007). Perceived efforts and costs were mostly targeted during the audio recording. This element of the campaign was the least remembered by the participants, which might explain why it did not work in the way it was conceived.

Paradoxically, the increased personal risk estimation and rating of severity of disease among intervention participants had a negative effect on water treatment. However, this might be a case where the reverse causality could be true: people currently treating their water feel less vulnerable to threats related to unsafe water. Similar findings have been reported in other studies (Huber & Mosler, 2013). Further, respondents possibly understood the questions on severity on disease in the same sense, whether they momentarily felt the consequences of diarrhea as severe and not in general, this was the case in the baseline study (Lilje, Kessely, & Mosler, 2015). Because of the cross-sectional nature of the data, we cannot conclusively say whether addressing the risk component in this case was helpful or not. Investigating the causality between changes in risk awareness and increased efforts in health protective behavior will be an interesting follow–up to this work. Taken together, this means that the selection of BCTs was largely appropriate for promoting water treatment among intervention participants because it targeted several important behavioral factors. The fact that not all those factors targeted with the intervention were positively affected and that not all factors which have an influence on behavior were necessarily significantly altered by the intervention reveals how the campaign design could be improved.

4.4.2 Limitations

While the first campaign proposal recommended to use radio as a supporting mass media communication channel to strengthen the delivery of the campaign messages, activities were reduced to community meetings only to allow complete randomization over study sites. This means that not all members of the targeted communities were exposed to the interventions. Due to the fact that intervention sessions were designed to be open to the general public meant that we could not compare changes in psychological factors over time but merely at the time of the evaluation survey, after interventions had taken place. Certainly, this limits the level of confidence in the findings presented here as we could not match the current sample with that from the baseline survey. Ideally, we could have matched respondents' data from this study to earlier surveys. This would allow to examine changes over time using difference–in–difference comparisons between the study groups instead of only inferring them by comparing cross-sectional.

For this evaluation respondents were selected by the documented presence of their household in the intervention activities. This possibly introduces a bias of self–selection into the activities by those households which were more interested beforehand. Self-reported health behaviors are prone to socially desirable responding; and over-reporting of socially desirable behavior can be expected (Biran et al., 2008; Curtis, Cousens, et al., 1993; Amal K Halder et al., 2010; Manun'Ebo et al., 1997; Stanton et al., 1987), especially in subjects participating in health campaigns (courtesy bias). However, if participation in the intervention is seen as a source of such bias, this would not explain positive effects in the control group. On the other hand, if mere participation in the survey and being subject to interviews on water treatment behavior is estimated to bias respondents answers, this should have equally affected responses along the different surveys in time as all subjects in this study were exposed to being interviewed extensively about their current water treatment practices and related thoughts and attitudes. On the other hand, self-reported information on health behaviors may be seen as valid as they have been shown to be associated with related health effects (Hutin et al., 2003; Luby, Amal K. Halder, Huda, Unicomb, & Johnston, 2011). In conclusion, the observed effects should be interpreted

with caution as long as there is no objective demonstration of increased water treatment rates (e.g. by measuring residual chlorine, which was not consistently possible in this study).

Data which relies on self-report, especially concerning health behavior, is known to be biased by several mechanisms (Contzen, De Pasquale, & Mosler, 2015; Furnham, 1986; Kahneman, 2011; Ram et al., 2011). This is a common problem in psychological studies, as attitudes and mindsets are typically cumbersome to measure objectively (e.g. via implicit measurement techniques). However, as the phenomenon is quite universal, it can be accounted for in the interpretation of data by comparing an intervention group with a control group.

Control group respondents for this study were therefore individuals who were named as participants by the promoters but who did not confirm having participated themselves. As this is a rather weak criterion for distinguishing between groups, we would have expected effects to be small if present at all, since all subjects were selected from within the same communities. The fact that differences were found between the two study groups in both self-reported behavior and psychological factors corroborates the significance of the results.

4.4.3 Implications/Outlook

The present campaign revealed some weaknesses and opportunities for improvement. To test the effects of interventions more reliably, communication channels that deliver the intervention to all targeted subjects should be considered. The usage of mass communication channels such as radio messages could diffuse the messages more consistently to a larger target population. The existing intervention strategies should be refined according to what has worked well and what mechanisms did not achieve the desired effects. Apparently, the campaign should be revised in the way it displays perceived efforts and difficulty of water treatment. Here, the campaign had a negative influence, maybe for the reasons discussed above. The risk factors were addressed in the desired way – raising risk awareness – however this resulted in a negative influence on water treatment. Raising risk awareness thus might not be the ideal way to increase the health behavior. While taste perceptions, injunctive norm, and social discourse had a positive influence on water treatment behavior, they were not significantly addressed by the campaign, revealing some potential for improvement.

A broader approach to the delivery of messages supported by mass media communication would also have been desirable and is recommended for future interventions in this setting. Stronger support and more intense preparation of promoters could have improved the delivery of intervention messages at community meetings. Further, the frequency and intensity of meetings could be increased if intervention sessions targeted whole communities instead of only a selection of participants. The interventions could also last for a longer period to allow more community members to participate when they have the time to do so. It could be expected that increasing numbers of people within the communities would start treating their water or talking about it as interventions gradually raised the community norm.

The sample size in this study is smaller than desired, but it is sufficient for the analysis presented here. To test and differentiate between the effects and effectiveness of the various intervention elements, it would have been helpful to design several intervention arms, each using a different combination of elements. However, the study design agreed upon between the project partners and the limited sample size and number of communities only allowed one intervention package to be

tested. This comprised all the elements, so the results can only be interpreted for the ensemble of strategies used.

4.5 Conclusion

Water treatment rates were significantly higher in households after participating in an intervention campaign using systematic behavior change components. Further, The self-reported treatment rate within intervention participants increased compared to a baseline study in the same region.

Psychological factors as mediatory variables indicate the effectiveness of these behavior change strategies in changing people's mindsets' toward chlorination of drinking water at the household level. While several of the targeted factors were positively affected by the interventions, only some of them significantly mediated its effect on behavior. Providing health knowledge paired with practical advice on how to implement it, such as the demonstration on how to treat water, proved to be a strong lever for behavior change. In addition, the organization of social support strategies within households helped. The strongest influence between intervention and behavior was participants' increased trust in their own abilities to perform and continue to do so. This shows that effective behavior change can be achieved by using psychosocial factors as leverage for behavior change. While the usage of risk awareness showed some possibly undesired effects on the targeted health behavior, taste, injunctive norm, and social discourse might have been stronger levers for behavior change that should be considered in the revision or further development of the campaign.

Therefore, the campaign tested here can be recommended as a basis to continue effective behavior change strategies promoting the treatment of drinking water for cholera prevention in the Lake Chad region.

4.6 Annex

TABLE 4.1: Descriptives of psychosocial factors and socio-economic variables for intervention and control groups.

	Descriptives				
Psychosocial factors	Intervention		Control		Diff
Factor					
	M	SD	M	SD	p
Vulnerability	2.82	0.81	2.40	0.65	**0.000**
Severity	2.69	1.05	2.06	0.77	**0.000**
Health knowledge	2.82	0.80	2.47	0.44	**0.002**
Taste	3.67	0.79	3.55	0.86	0.331
Perceived efforts	3.76	1.15	4.24	0.74	**0.003**
Perceived costs	3.86	1.04	3.93	1.09	0.679
Perceived benefits	3.60	0.80	3.36	0.75	0.045
Descriptive norm	2.56	0.57	2.35	0.79	0.036
Injunctive norm	2.53	0.99	2.33	0.91	0.164
Personal norm	3.19	1.00	2.91	0.91	0.066
Social support	3.12	1.21	2.72	1.09	**0.030**
Social Discourse	2.86	1.05	2.60	1.34	0.133
Action knowledge	3.97	0.71	3.10	0.95	**0.000**
Difficulty	4.12	1.06	4.45	0.86	**0.034**
Self-efficacy	3.20	0.93	2.61	1.00	**0.000**
Socio-economic variables					
Age (years)	32.6	10.22	35.4	14.61	0.108
Sex (% female)	90.1		69		**0.000**
Marital status (% married)	93.8		79.3		**0.001**
Literacy (% can read and write)	68.5		87.9		**0.004**
Household members	6.9	3.60	8.8	5.11	**0.003**
SES score	5.5	2.12	5.2	2.31	0.297

Note: M = Mean; SD = Standard deviation; p = p-value, significant differences at alpha .05 are highlighted in bold.

TABLE 4.2: Results for mediation analysis on the effect of interventions on water treatment through psychological factors from the RANAS model.

	a path			b path			axb path			
	coefficient		SE	coefficient		SE	effect	SE	LL	UL
Vulnerability	**0.43**	***	0.19	**-0.63**	**	0.2	**-0.27**	0.12	-0.56	-0.09
Severity	**0.62**	***	0.15	**-0.58**	***	0.16	**-0.36**	0.14	-0.7	-0.15
Health knowledge	**0.34**	**	0.11	**0.8**	***	0.22	**0.28**	0.1	0.11	0.53
Taste	0.12		0.12	**0.82**	***	0.2	0.09	0.11	-0.1	0.34
Perceived efforts	**-0.49**	**	0.16	-0.11		0.13	0.05	0.07	-0.07	0.22
Perceived costs	-0.07		0.16	**0.3**	*	0.14	-0.02	0.05	-0.16	0.07
Perceived benefits	**0.24**	*	0.12	0.28		0.18	0.07	0.06	-0.01	0.24
Descriptive norm	**0.21**	*	0.1	**1.1**	***	0.28	0.23	0.15	-0.01	0.59
Injunctive norm	0.21		0.15	**0.95**	***	0.19	0.2	0.15	-0.08	0.5
Personal norm	0.28		0.15	**0.63**	***	0.16	**0.17**	0.1	0.01	0.43
Social support	**0.39**	*	0.18	**0.89**	***	0.15	**0.35**	0.16	0.06	0.71
Social Discourse	0.26		0.17	**1.41**	***	0.21	0.37	0.3	-0.16	1.03
Action knowledge	**0.87**	***	0.12	**0.51**	*	0.19	**0.44**	0.19	0.12	0.86
Difficulty	**-0.33**	*	0.15	0.27		0.14	-0.09	0.06	-0.26	0
Self-efficacy	**0.6**	***	0.15	**1.1**	***	0.19	**0.66**	0.22	0.31	1.19

Note: N = 220; a-path = effect of the intervention on psychological factor; b-path = effect of the moderating factor on behavior; axb path = indirect (mediated) effect of the intervention on behavior through the mediator; SE = standard error; LL= lower limit; UL = upper limit. Indirect effects were calculated using 5000 bootstrapped samples estimating 95% confidence intervals. Significant results in bold; levels of significances: * p < .05; ** p < .01; *** p < .001. P-values generated from the regression coefficients, standard errors, degrees of freedom, and t-statistics of the simple regression models (see Preacher & Hayes, 2008)

Chapter 5

Overall discussion

5.1 Overview

This thesis aimed at developing and testing a theory and evidence-based intervention to promote chlorination of household drinking water in the context of cholera prevention activities in the Lake Chad Basin, in Central Africa. The Risk, Attitude, Norms, Abilities, and Self-regulation Model (Mosler, 2012) was used as a theoretical basis for this work, supplemented with additional factors where appropriate. A campaign proposal for behavior change was suggested on the basis of some baseline research in the field systematically assessing relevant socio-economic, contextual, and psychological factors for the uptake of drinking water chlorination (Study 1). Long-term continuation of the same target behavior was studied following part of the sample of Study 1 over time, looking at differences in changes in behavior and associated psychological factors between subjects who continued to treat their drinking water and those who had stopped to do so in the meantime (Study 2). A behavior change campaign targeting the uptake of drinking water chlorination was elaborated on the basis of the formative baseline study. This campaign was then implemented in collaboration with the Ministry of Public Health in Chad in several project communities. The evaluation study (Study 3) tested the effectiveness and psychological mechanism of the intervention campaign in promoting the uptake and usage of chlorination for drinking water treatment among participating households.

The presented work sketches the first comprehensive, structured, and theory-based approach towards understanding chlorination behavior of households using health psychological theory. Regarding the scientific literature available at the starting point of this project, not much had been found in terms of evidence on cholera prevention behaviors in general that could have helped informing the conception of this project. There was also a lack of literature on the issue of household water treatment in the Lake Chad region specifically. Although several reports on WASH issues existed, none of them provided detailed information on behavioral factors that are important determinants of water treatment behavior on the household level in the study region. One of the best information sources on the cholera problematic in the Lake Chad region has been compiled by UNICEF (Oger & Sudre, 2011). It is however limited to an epidemiological understanding of the cholera dynamics and the general link between cholera and the WASH situation. Different environmental and technological contextual factors are described as potential risk factors for the spread of cholera, but it lacks an assessment of individual behavioral factors motivating people to engage in protective behaviors. Another strength of this work is the longitudinal study on behavioral continuation of drinking water chlorination. Study 2 followed a sample over time before they were exposed to any kind of interventions. This approach allowed to not only understand relevant psychological

factors for starting a new health behavior, but also understanding which factors lead to a sustained maintenance of the same behavior.

This work therefore adds to the evidence on psychological factors for safe drinking water behaviors, and shows how to specifically promote the uptake of drinking water chlorination in a population at high risk of cholera epidemics. It further provides a collection of important factors and questions to consider when studying or promoting different water treatment options from a behavioral perspective. This is the first systematic assessment of behavioral determinants of drinking water chlorination, especially in the context of cholera epidemics, where this behavior is thought to have highly beneficial effects on consumers' health. This work not only addresses drivers and motivators of chlorination adoption, but also studied factors for sustained chlorination behavior over time. Further, a theory-based behavior change intervention was designed to promote the uptake of drinking water chlorination, which were specifically tailored to the target's population mindsets and needs.

5.2 Summary of findings

The main findings of the studies included in this thesis shall be summarized in the following. In detail, the three chapters examined different aspects of psychosocial factors for the promotion and uptake, and long-term continuation of drinking water chlorination in a given setting. The main findings of these three studies will be shortly summarized in the following. These will be organized along the research questions formulated in the introductory part of this thesis.

5.2.1 Answers to research questions

What is the current situation concerning water treatment behavior in households and are there important environmental or technological factors influencing water treatment behavior in Chad? Study 1 revealed that the current rate of drinking water treatment was around 30% in the studied sample which was drawn across ten distinct communities spread along the Lake Chad river basin. This means that, based on their self-report, about every third household interviewed currently engaged in treating their drinking water at the household level. This figure is comparable to findings in other at-risk settings for cholera outbreaks such as during the outbreak in Haiti prior to intervention promoting the disinfection of drinking water (De Rochars et al., 2011). However, in general, this number most likely overestimates the actual rates of drinking water disinfection in homes as can be seen in other studies on the same target behavior (Figueroa & Kincaid, 2007; Lantagne, Quick, & Mintz, 2006; Luby, Mendoza, et al., 2008; Rainey & Harding, 2005). This can be expected from mechanisms of bias and over-reporting in the context of socially desirable responding in person-to-person interviews (Biran et al., 2008; Contzen, De Pasquale, & Mosler, 2015; Amal K Halder et al., 2010; Ram, 2010; Stanton et al., 1987). Personal risk evaluation for diarrheal diseases and cholera in specific was generally low among the study population.

Concerning basic knowledge on the topic, a little more than that, around half of all respondents interviewed, were able to name at least one method to treat water for safe consumption. The most commonly known method was chlorination among others, which was also the method most commonly applied. Knowledge on water treatment was significantly lower among non-users of water treatment options. This group was also economically less off than performers of water treatment. In terms

of environmental and technological factors no important differences were identified between the groups of current water treatment users and non-users. "Lack of material" or "limited financial resources" were most often stated as important barriers for not performing water treatment (see Study 2).

What are the psychological determinants for the promotion of water treatment at the household level and how should they be addressed in interventions? Based on the identification procedure described in Mosler and colleagues guideline on systematic behavior change (2016), the most relevant psychosocial factors for water treatment were identified comparing Doers (people currently engaged in the behavior) with NonDoers (people currently not engaged in the target behavior). Relevant factors influencing subjects' water treatment behavior were found to be personal risk evaluation as it was generally low, others' people's behavior as well as others' approval of treating drinking water, the level of social support one received in performing chlorination, and the extent this was subject to communication among community members. Self-efficacy convictions revealed a moderate influence on the target behavior. The implications for a potential promotion campaign were to target the populations awareness of the potential risk for diarrheal diseases related to unsafe drinking water, strengthening the existing social norms in favor of water treatment by highlighting others' behavior and approval as well as intensifying the level of support and communication on the topic, and supplying practical advice in order to foster knowledge and increase estimated abilities to correctly perform water treatment.

Can subgroups of people or disadvantaged groups be identified on the basis of differences in environmental, technological, socioeconomic, and psychological factors? A distinct subgroup of people was identified within this work, that substantially differs from the majority of the rest of the randomly drawn sample. This subgroup significantly deviated in a range of socio-economic factors from the rest of the sample and also displayed important differences in their psychological mindset concerning water treatment activity. On the basis of the data assessed, this subgroup seems to be best described as the bottom quintile (Wisner, 2004), representing the economically least off people, often living in the most rural parts of the community, with less access to services and markets. From the psychological perspective, this group revealed to have less knowledge about water treatment, stated that water treatment was less beneficial and more costly to them compared to the rest of the sample, and displayed weaker existing norms towards drinking water disinfection and less confidence in their ability to engage in it. These findings are in line with this group being economically worse off that the rest of the sample, being less educated, living in more rural areas and larger household sizes. This led the authors of the study to the conclusion that an adapted strategy would have been necessary to distinctively address this group. Within the given project, this was however not feasible to do.

Which psychological factors show differences between subjects continuing and those stopping water treatment? Continuers of water treatment showed to be more knowledgeable on health issues. Continuers rated the taste of treated water higher than stoppers, while stoppers liked the taste of untreated water more than continuers. Further, continuers thought more beneficial of water treatment compared to stoppers and thought that more people were actually doing it. Their personal norm

was higher, they provided or received more social support from their family members in doing so, and communicated more frequently about the matter with others. Further, continuers of water treatment were a lot more confident about their own abilities to continuously perform water treatment and showed thoroughly more positive self-regulation factors.

Which psychological factors change over time when people continue or stop water treatment? Several factors evolved over the course of time between measurements in both groups of continuers and stoppers of water treatment. From the first to the second survey, subjects' health knowledge increased potentially through being subject to the surveys alone. Both groups also thought of water treatment as less effortful and more beneficial. The rating of the severity of diarrheal disease and descriptive norm decreased over time and both groups.

Which psychological factors change differently over time between the two groups? Normative factors such as others' behavior, personal obligation, social support and discourse, perceived self-efficacy convictions, action control, and intention best discriminated between the two groups and developed significantly more positively over time for continuers of water treatment compared to subjects who had stopped to do so. These factors should be considered when designing interventions intended to lead to sustainable behavior change.

Did the campaign have a positive impact on water treatment among intervention participants? The evaluation study found a substantial effect of the intervention campaign on its participants. Households whose members had taken part in any of the promotion activities reported significantly higher rates of water treatment in their homes compared to people from the same communities who did not visit any of the intervention sessions. Further, compared with the two earlier samples in Study 1 and 2, the chlorination activity was much higher in the sample which had experienced the interventions than in any of the previous ones.

Did the campaign affect psychological factors for drinking water treatment that were targeted by the campaign? The intervention not only led to changes on the behavioral level, but also altered participants mindsets' in favor of drinking water chlorination. The campaign successfully addressed participants' risk awareness, revealing increased levels of perceived vulnerability to and severity of diarrheal diseases. The campaign also successfully communicated knowledge on the association between safe drinking water and health, it led participants to think of water treatment as more beneficial, and made them think that more people in their surrounding were actually engaging in this behavior, thus strengthening the perceived norm. The campaign fostered social support within families to enact water treatment, made its participants more knowledgeable about how to perform it, and strengthened their confidence in performing and continuing water treatment over time despite difficulties.

However, the campaign did not successfully address perceived costs, injunctive norm, and social discourse as planned. This might be due to flaws in the implementation process of certain campaign elements which were designed to mainly address these factors. Unexpectedly, the campaign had a negative effect on perceived efforts and difficulty, making participants think of water treatment as more effortful.

Which of these psychological factors mediated the effects of the campaign on behavior? The overall positive effect of the intervention on participants' drinking water chlorination behavior was mediated by changes in the following psychological factors: Increase in health knowledge, perceived others' behavior, social support, action knowledge, and perceived self-efficacy. Perceived vulnerability and severity also had a mediating effect on the behavioral outcome, their contribution however, was of negative nature, potentially due to a reverse causality effect in participants' risk awareness.

5.2.2 Effects of the designed campaign on chlorination behavior

Study 3 showed the positive effects of the implemented behavior change campaign on drinking water chlorination among its participants. Households in which at least one person had participated in any of the intervention sessions reported significantly higher water treatment rates compared to those households which did not confirm their participation in any of the activities.

In order to further support this point, the water treatment rates in the different samples studied over time are displayed in Figure 5.1. Although the different samples studied at the different time points do not or only partially match, this comparison can serve as another indicator of the positive effects of the campaign. While the overall treatment rate among respondents at the first three time points (Nov. 2013 and May 2014 representing the sample of Study 1, and Oct. 2015 representing the sample of Study 2) was about stable between 20 and 30%, representing around one quarter to one third of surveyed households currently reporting to treat their drinking water, this rate was visibly higher at the fourth timepoint (July 2016, Study 3) after the intervention had been implemented (between Oct 2015 and Jul 2016) in the study communities.

Two observations are further of interest here. First, it is noticeable that the mean chlorination rates at the time of the first three survey points was not significantly different. This is especially noteworthy as these samples were drawn from within the same areas and communities along the project timeline, but at different seasons of the year. While the month of November is a typical month of the dry season, May represents the onset of the rains commencing the rainy season. October again, marks the end of the rainy season when the dry time of the year begins. As has been pointed out earlier, the rise of risk for cholera or the outbreak of actual epidemics is usually linked to changes in the aquatic/hydrologic environment (Jutla et al., 2013; Luque Fernández et al., 2009; Richard et al., 1999). With the onset of the rainy season, environmental factors are most favorable to the spread of the vibrio cholera in different settings on the African continent. Because of this close link, it is concluded, that people would usually start investing in protective behaviors around the time of rising risks – especially in settings which are and have been repeatedly struck such as in the Lake Tchad Basin. However, the data presented here does not support this assumption. It shows no significant changes in water treatment behavior regarding the season of the year. This means that people in this study population are not necessarily directly reacting to environmental threats. This findings rules out the effect of seasonality on the measured target behavior.

Even more interesting is that the perceived risk for contracting cholera disease has been estimated rather low by the subjects in Study 1, despite the fact that many of them had experienced cases within their families below. This confirms the finding that experience and knowledge around a disease and risk awareness alone do not necessarily translate into protective action (Claassen, Henneman, Kindt, Marteau, &

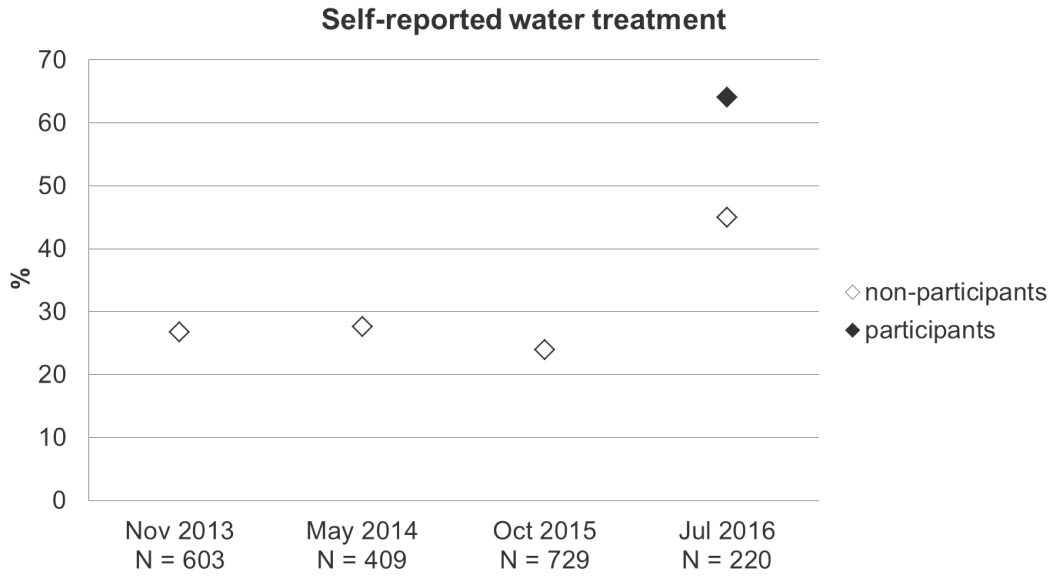

FIGURE 5.1: Proportion of respondents (in %) reporting to currently treat their drinking water at the time of the different surveys. A behavior change campaign promoting the uptake of chlorination for drinking water treatment was implemented between the surveys conducted in October 2015 and July 2016. The July 2016 sample is divided into participants of the interventions and non-participants from within the same intervention communities.

Timmermans, 2010; Radtke, Scholz, Keller, & Hornung, 2012; Schwarzer & Luszczynska, 2008).

The second interesting finding about Figure 5.1 is the fact that not only participants of the intervention (black diamonds) show higher rates of water treatment after the intervention than the samples drawn before, but also non-participants (white diamonds) seem to have increased their chlorination behavior albeit to a lesser extent. This speaks for a potential diffusion process of the intervention into the targeted communities, as the control subjects for Study 3 were drawn from within the same communities that had received the intervention. From a practical perspective, this is a positive finding, showing that not only the active participation in the intervention activities, but also indirect paths led to a change in chlorination behavior.

5.3 Theory implications

In the following section, the findings of the empirical studies included shall be reflected upon on the basis of the theoretical framework presented in the introduction. In particular, it shall be collected on which topics evidence could be gathered during the empirical works, and where there is still a lack of knowledge and findings that might be worth studying in the future. By comparing the results of the three studies included here, it is possible to generate a broader view on the importance and relevance of different factors for the targeted behavior of drinking water chlorination.

5.3.1 Implications for the proposed framework

The introductory part of this thesis suggested a collection of theoretically important factors for consideration when choosing between different drinking water treatment

technologies. Three options, solar water disinfection, filtration, and chlorination were considered and discussed along their psychological profiles corresponding to the RANAS model. Their relevance and applicability will be discussed in the light of the results from the three studies presented above as well as a review on the relevance of psycho-social factors for different safe water options based on evidence from a range of case studies across several countries. The aim of this section is to collect generated evidence on the importance of different psychological factors for the target behavior of drinking water chlorination. This will be done highlighting where and how the conclusions of each study contributes to understanding the relevant factors from a psychological perspective and embed these into existing knowledge.

Risk factors

Risk factors, such as perceived vulnerability and severity of diarrheal disease, and knowledge about the link of unsafe water and disease showed a mixed picture in terms of their relevance for drinking water chlorination. While it was found in Study 1 that risk awareness was rather low in the studied population, their potential for using it in future interventions was rated as moderate to high. This, however, was due to the generally unfavorable attitude of the population in consideration of the threats posed to their health by diarrheal diseases and cholera specifically, and not necessarily only in regard of the quality of drinking water they consumed. This finding therefore does not allow to judge the specific contribution of the risk factors to the behavioral outcome of drinking water chlorination. It further does not reveal whether risk factors show any difference in regard to what safe water technology would be proposed to be promoted. It rather seems that a minimal level of risk awareness and knowledge about the contribution of safe drinking water towards better health is necessary for the acceptance and adoption of any kind of safe water technology (Schwarzer, Lippke, & Ziegelmann, 2008).

Both, perceived vulnerability and severity showed significant interaction effect between continuers of chlorination and those subjects who had stopped to use chlorination over time. It was shown that while continuers initially estimated their personal risk for diarrheal diseases higher, they thought about it as much lower compared to subjects who had stopped to use chlorination over time. This could be an effect of reverse causality (Contzen & Mosler, 2015; Norman et al., 2005), meaning that the factor not necessarily influenced persons' behavior, but rather the fact that some subjects continued to use the safe water option made them feel better protected from disease. Again, no conclusion can be drawn here in how far this would differ from other safe water technologies.

There was a positive trend over time in health knowledge for both of the groups of continuers and stoppers which could be best linked to their exposure to the topic of chlorination and general household hygiene during the different surveys. No difference in evolvement over time between the two groups was found.

In terms of the role of the risk factors in the effects of the behavior change campaign, health knowledge fulfilled the expectation that increased knowledge of intervention participants was associated with an increased behavioral level. Vulnerability and severity also significantly mediated the effects of the intervention on participants behavior, however in an unexpected way. Increased risk awareness was associated with decreased levels of behavior, potentially due to a reverse causality effect as described above.

Attitude factors

In line with the hypothesized framework, perceived monetary costs were not a significant barrier for the adoption of chlorination in the studied population. Neither were there any significant changes over the long range that would indicate their relevance for its continued usage. This finding supports the hypothesis, that due to the relatively low monetary costs, affording the necessary products for drinking water chlorination does not seem to be an issue. After all, none of the attitudinal factors under study here seemed to influence people's decision making in the usage or non-usage of chlorination products, revealing no significant potential for intervention in Study 1. Taste preferences did not differ between subjects using chlorine products and those who did not.

However, over the long range, differences existed in attitudes towards chlorination between subjects who continued using this treatment option and others who stopped to use chlorination in their households. Continuers saw more benefits in treating their water, apparently, this influenced their decision to hold on to this behavior. Perceived efforts slightly increased over time in both groups of continuers and stoppers of chlorination, which might reveal the eventual notice of the time and energy that it actually takes to plan and effectuate chlorination on a regular basis.

Further, there was a group effect of taste preferences. While continuers rated the taste of chlorinated water higher than stoppers, stoppers had a higher preference for untreated water. This is in line with findings from other studies examining the effect of taste alterations of chlorine on drinking water on consumers acceptability and preferences (Crider et al., 2017; Freeman et al., 2009; Luby, Mendoza, et al., 2008). In the evaluation of the implemented campaign, again, none of the attitudinal factors revealed significant moderating effects on the targeted behavior, which can be explained as none of these factors was specifically targeted during the intervention campaign.

Although costs were not a relevant factor for the majority of the sample, they might be more relevant for specific subgroups of people who are economically less off, as in the identified subgroup from Study 1. Lack of financial resources and materials were the most often stated reasons of people who had stopped treating their drinking water after they had done so for a while in Study 2. Time costs and efforts were not mentioned by any of the respondents in the three studies as a potential barrier or impediment for using chlorine to treat their drinking water, which again confirms the hypothesized relative ease in using chlorination as a means for disinfecting drinking water compared to e.g. using solar water disinfection.

Norm factors

Norm factors were among the most important factors in all three of the presented studies. Norm factors generally revealed the greatest differences between Doers and NonDoers of water treatment in Study 1. Especially others' people behavior (the descriptive norm) and others' approval (the injunctive norm) as well as the level of social support and discourse about water treatment showed the highest potentials for intervention. This does not match the hypothesized independence of chlorination from other people's behavior as postulated in the introduction. It seems that despite the fact that chlorinating drinking water might not be very visible to outsiders of the household, it is – at least in the studied population – very well dependent on what people think other people in their neighborhood do and think about it. Several mechanisms are considerable to explain this discrepancy. On the one hand, the act

of chlorination and using chlorinated water for drinking within a household might not be that invisible to other people, as drinking water storage containers might be placed outside the houses within the yard where they are more visible, or visitors will simply detect that the drinking water served to them contains chlorine.

Another explanation is that acts of the daily life such as household routines are a matter of discussion among community members. This potential explanation for the importance of social norms is backed by the finding that social discourse on chlorination, that is the amount people discuss water treatment as a topic of conversation between them was an important factor explaining chlorination behavior. Social support was another factor identified, which was important for water treatment at the time of the baseline study (Study 1). This factors assessed the level of perceived support by the caregiver in the household from the head of household in their intention to regularly treat their drinking water.

Over the course of time, the descriptive norm evolved more positively for continuers compared to stoppers of drinking water chlorination. Apparently for people who continued with their efforts to regularly treat their drinking water, the impression that other people were engaged in this behavior was consolidated, whereas the increased difference between continuers and stoppers at the time of the follow-up study (Study 2) mainly came from a decrease in descriptive norm within stoppers. These seemed to have gained the impression that less other people were engaged in water treatment at that time compared to the baseline survey. This might also be influenced by their own lapse in behavior as one's own behavior might be the reference to estimate others' behavior.

Social support and social discourse – two of the factors added to the RANAS model in the presented studies – revealed significant interaction effects over time, with continuers showing increasing values in both of these factors over the course of time and values for stoppers decreasing over time. This reveals the importance of different kinds of social supporting mechanisms for chlorination behavior. Others' approval (injunctive norm) and personal importance did not significantly change over time.

In the evaluation study (Study 3) examining the effects of the behavior change campaign, all norm factors again revealed their importance for the target behavior resulting in some significant b-paths in the mediation analysis. However, only the personal norm and social support revealed significant indirect effects of the intervention on behavior. Descriptive norm also had borderline significant values. Apparently these three factors from the normative component were both, successfully addressed within the campaign and translated into measurable effects on chlorination behavior. Injunctive norm and social discourse were apparently not very well addressed by the campaign and did therefore not translate into effecting the target behavior.

Among the other determinants studied here, the descriptive norm, capturing what people think how other people around them behave, has been identified as the most prominent psychological determinant for peoples' engagement and significantly predicted peoples' engagement into safe water behaviors in most of the studied cases were it was assessed (Lilje & Mosler, 2017).

Ability factors

Self-efficacy revealed a moderate intervention potential in Study 1, but was one of the very important factors throughout the other two studies. Perceived abilities of respondents showed a significant interaction effect in the long run with values of

continuers increasing and those of stopper decreasing over time. Self-efficacy was also one of the significant moderators of the intervention effects on chlorination behavior in the campaign evaluation. This is in line with the psychological literature on health behavior, not only in the developing context, showing that perceived abilities to change and maintain an alternative healthy behavior are important at all stages of behavior change (Ajzen, 1985).

Action knowledge, capturing knowledge around water treatment options and necessary behavioral steps for chlorination was another factor revealing differences between Doers and NonDoers of water treatment during the baseline revealing its potential for the adoption of water treatment behaviors.

These findings are in line with the postulated characteristics of chlorination made in the introductory part, where chlorination was depicted as one of the relatively more complicated treatment options. Action knowledge on how to perform the necessary behavioral steps involved in the process such as correct dosing and frequency of treatment are important factors on the way to behavioral adoption and its continuation over time. On the other hand, specifically asked for the difficulty of water treatment during Study 1, this was not a relevant factor differing between users and non-users, and it also had no effect in the long run. This contradicts the hypothesis that chlorination is a more complicated treatment behavior on the first sight. However, in the campaign evaluation, it showed that difficulty was negatively affected by the intervention revealing that participants might have had a somewhat naive perception of chlorination beforehand and might only have learned what is actually necessary to treat drinking water during the intervention.

In conclusion, abilities, factual knowledge as well as perceived self-efficacy, seem to be an important aspect of drinking water chlorination in the given setting. Further, ability factors significantly mediated the effects of the intervention on the target behavior. Self-efficacy convictions were also found to be the second most important factor across several safe water behaviors in different populations (Lilje & Mosler, 2017). This finding was confirmed by the studies presented here. Confidence in one's own abilities to be able to perform the necessary steps to chlorinate drinking water were highly predictive of peoples' actual behavior (Study 1) and also for the continuation of chlorination behavior over the course of time (Study 2).

Self-regulation factors

Factors capturing self-regulation mechanism were generally more difficult to capture within the presented studies. During all surveys, parts of the samples had never been or were not engaged in drinking water treatment at the time of the survey. These subjects were not able to answer questions about their mindset regarding self-regulation factors. This made it impossible to compare NonDoers to Doers in regard to self-regulation factors in Study 1. In Study 2, some evidence was found on the relevance of action control specifically for the continuation of chlorination over time compared to people who stopped using it. Again, during the campaign evaluation study (Study 3), self-regulation factors were not considered due to the difficulties mentioned. A detailed discussion on the difficulties measuring self-regulation factors can be found in the section on limitations.

5.3.2 Practical implications

Based on the findings from the different studies presented within this work, some recommendation can be concluded that can serve the practitioner in the field working on similar projects, especially when comparing the results from individual case studies with other studies within the same population or on the same target behaviors, as has been done for example in a multi-county review on different safe drinking water options (Lilje & Mosler, 2017).

Reviewing the results from Study 1 and Study 2, it can be concluded that some of the psychological factors determining the usage of chlorine products to treat drinking water on the household level are more relevant than others, both in picking up and maintaining the behavior over time. In conclusion, the following factors were repeatedly identified to be important for drinking water chlorination, its uptake, maintenance, and its promotion: risk factors including vulnerability, severity, and health knowledge, norm factors including the descriptive norm, personal importance, social support, and social discourse, and ability factors including factual knowledge and self-efficacy. Those factors thus confirmed their relevance for drinking water chlorination in the given study setting and should be addressed in future campaigns targeting the same behavior. Others factors were of less importance, such as attitudes on perceived costs and efforts and benefits of chlorination, and also the taste of chlorinated vs. untreated water, the injunctive norm, and perceived difficulty of chlorination. These factors were not or not consistently associated with the behavior, and should thus be regarded as less important in the promotion of chlorination behavior in similar settings.

The fact that none of the socio-economic factors had a strong direct effect on water treatment behavior in the presented studies highlights the importance of psychological factors for drinking water chlorination behavior. This shows how crucial it is to not limit field studies to a mere knowledge and practice assessment, but to look deeper into peoples' mindsets around the target behavior under study. While some of the personal context variables might have an indirect effect on water treatment behavior in the end, as discussed within the presented framework in the introductory part of this thesis, the mechanism of how these effect the behavioral level seems to lie within the psychological mindset of the people. Individual or household wealth for example, the height of a family's income certainly influences their ability to spend part of their available funds in disease prevention behaviors. However, in the presented studies, estimated costs of water treatment were not an influential factor on the sample population's actual engagement into water treatment, except potentially for a smaller subgroup distinct from the majority of the sample population. Therefore, focusing on these factors should, under similar conditions, not be a primary focus in the design of campaigns for drinking water treatment promotion.

The finding that not only direct intervention participants, but also non-participants within the targeted communities targeted by the intervention showed some positive behavior change (Figure 5.1) might be explained by the fact that the amount of communication on the topic was a highly relevant factor for behavioral adoption and continuation throughout the presented studies. The intervention sessions might therefore have sparked conversation around the topics of diarrheal disease, cholera, and drinking water treatment as a protective option and is in line with the literature pointing out the importance of communication for the diffusion of innovations (Rogers, 2010; Rogers & Shoemaker, 1971).

To conclude with, the developed framework can be used by interested scientists or practitioners, to support their informed decision making process in choosing

appropriate safe drinking water options across different populations and settings. Although far from complete, this framework can serve as basis or checklist-style collection of potential leverages to identify potentially relevant factors for individuals' water treatment behaviors and whether all of them have been considered.

5.4 Limitations of this work

There are several limitations to the presented studies which have been discussed in the individual chapters; however, some of the overarching themes shall be discussed in more detail in the following section by topic of interest.

Generalizability First of all, it should be noted that the results are based on findings and reporting from a specific study population within a specific setting and environment. Not all places and populations are the same. This means, that the findings should be regarded as what they are, a non-generalizable single case study. This is true for other projects and studies working on health behavior change in the WASH sector in developing countries. The same psychological factors might not be relevant in different settings within a different population as can be concluded from a systematic review on behavioral factors for safe water behaviors in several countries across different continents (Lilje & Mosler, 2017). The findings presented here thus represent a single case, and the evidence provided can merely be used to estimate what might be universally relevant for chlorination behavior in distinction to other safe water options.

Sampling Unfortunately, along this project, it was not possible to sample the same persons over the course of the different surveys that would have allowed to perfectly match results of the different surveys. After the first round of interventions were implemented in half of the study communities (while the other half were treated as a waiting control group), it showed that only a very small proportion of the baseline respondents had actually taken part in the campaign activities. This was most likely explained by the public setting of the intervention session. Although the baseline respondents were primarily targeted and invited to participate, the session were open to everyone interested in the selected communities which led to a diffusion of the information into some of the study households but not necessarily limited to those. On the other hand, this also means that not all study subjects necessarily participated. The low level of participation by the baseline respondents impeded a systematic evaluation of the campaign effects on these subjects in the first place.

The sample drawn for Study 3 was therefore selected from within the protocolled participant lists which were available from the program monitoring. This meant that subjects in the evaluation study were not necessarily represented in the two previous study samples. This difficulty made it impossible to compare the same subjects from before and after the interventions, but only allowed to estimate the campaign's effects by comparing those who confirmed their participation with non-participants from within the same communities.

Intervention delivery This problem is related to difficulties in the intervention delivery or fidelity, both in terms of quantity of targeted beneficiaries reached and quality. The problem depicted above which arose during the first attempt of evaluating the implemented interventions was specifically linked to the limited diffusion of the campaign contents via the chosen communication channels. One solution to this

problem would be to adapt the communication strategy of the campaign using mass media or other channels that could reach a broader audience than individual community meetings that limit the number of beneficiaries both by their nature of the physically and timely limited mode of presentation.

Based on monitoring data on the intervention delivery and responses of the sampled participants on their experience with the interventions, it was also noticed that not all elements of the campaign were delivered as planned. Especially the audio broadcast element (which had been designed to be diffused via radio stations in the first place) was not universally utilized. Further problems were linked to the presentation of the spot on the supplied playback devices in crowded or very loud places such as nearby streets which impaired the perception of the contents on the audience's side. Another way of increasing the quality of intervention delivery to the targeted households would have been to organize individual household visits, guaranteeing that each household within the study sample would have had a better chance of being exposed to the interventions. This was however not plausible due to financial constraints and ethical considerations of limiting the intervention to only few households within each community.

Outcome measure Despite some consideration, objective measurement of drinking water chlorination was not systematically used within this project, although simple methods exist to e.g. measure residual chlorine in stored drinking water (Murray & Lantagne, 2015). This would have allowed to validate the self-reported chlorination behavior of subjects who claimed to practice water treatment during the survey interviews. As previously discussed, data which relies on self-report is generally prone to bias for several reasons (Contzen, De Pasquale, & Mosler, 2015; Kahneman, 2011; Ram, 2010; Stanton et al., 1987). Socially desirable behavior can be expected to be over-reported because subjects feel they should be answering in a desired way (Biran et al., 2008; Curtis, Cousens, et al., 1993; Amal K Halder et al., 2010; Manun'Ebo et al., 1997; Stanton et al., 1987). Especially in the context of developmental work, answers to surveys concerning health related topics can be alienated for specific reasons such as conflicting or hidden interests. On the one hand, subjects might be over-stating their current health behaviors in order to appear "good", possibly expecting to be rewarded for their efforts. On the other hand, subjects might be describing their situation as worse than they actually are highlighting their needs in expectation to profit from a project or a previously announced campaign. This has been often the subject of discussion with responsibles of the visited study communities who tried to convince the research team of their needs.

This means that no objective validation of the self-reported behavior were captured throughout the empirical studies presented, which is an often cited reason for critique. On the other hand, self-reported information on health behaviors may be seen as valid as they have been shown to be associated with related health effects (Hutin et al., 2003; Luby, Amal K. Halder, et al., 2011). Further, it does not seem evident in the case of residual chlorine testing that this method would deliver more reliable results of the actual, current treatment behavior within a household. This is for several reasons. First of all, sampling the available drinking water at the time when the household is visited for the interview merely provides a one-point-in-time measurement. As previously mentioned, some of the households that declared water treatment did not have stored water in the home at the moment of visit. Others explained they had not yet treated their water on that specific day or forgot to do so. Some reported the likelihood of under-dosing of larger containers or that the

product had been finished in the last days and the head of household had not yet provided them with a new one.

People do not necessarily treat their drinking water every day or at each time water is collected. Findings from qualitative answers also suggest that participants explained they had not yet treated on that day or that they had run out of product although they are currently treating their water on a more or less frequent basis. Moreover, people integrate their behavior over time, that is they report what they have been doing in the recent past. This is something a one-point objective measure cannot display – and another reason why the self-report might actually be more reliable in this case.

Future ideas to overcome this problematic contain a continued monitoring of chlorination behavior over time, possibly restricted to a subsample of the study participants. This could generate a validation of self-report at several points in time, and therefore produce a more reliable source of information than the self-report alone or a one-time objective measurement. Another way of asking for chlorination would be to ask people to aggregate their behavior over a longer period of time such as during several days of the week or month to generate a measure of “habitual" behavior rather than behavior at a single time point.

Difficulties in measuring self-regulation factors Factors from the self-regulation component were generally more difficult to assess as previously discussed. In all three of the presented studies, parts of the samples drawn were at that time not at all engaged in drinking water chlorination. This means that questions about self-regulatory mechanisms were not possible for them to answer for the most part. This is especially true for people who have never even tried to perform the behavior and do not have any experience with chlorination and what it takes, means, and feels like to effectuate it. Questions about how much a person pays attention to his or her own current behavior, how he or she deals with arriving problems are not possible to be answered for this group of persons as it lies outside their range of experience. This posed a problem in assessing these factors in all three presented studies and means that the findings concerning these factors are less reliable, if at all presentable (compare e.g. the discussions of the individual studies). This problem speaks for an assessment of users at different stages of the behavior and extending the underlying theoretical model to discriminate between behavioral phases (Rothman et al., 2004) or to identify different user types at different stages of the behavior (see e.g. Tamas and Mosler (2011)).

As the outcome of drinking water chlorination at the time of the surveys was measured as either shown or not, it was not possible to gradually discriminate between people who are strongly engaged and those who are less engaged to estimate a behavioral intensity. This is for example easier in more commonly practiced behaviors such as e.g. handwashing with soap which is most often shown at least sometimes by most people. This means that for these behaviors, most people have some kind of experience in carrying it out, so that they are at least able to hypothetically answer questions about self-regulation mechanisms. On the issue of chlorinating drinking water, as depicted in Study 1, many people did not even know about ways of water treatment at all. This means that they do not possess any kind of experience with the behavior at question and were therefore not even able to tell about potential barriers and how to deal with them as an example of regulatory factors.

The little evidence on self-regulation factors that could be generated within the presented work comes from Study 2, where only subjects were interviewed who had initially reported that they had been engaged at least temporarily in performing

drinking water chlorination. However, also here, it showed that people who did not report any kind of intention to treat their water could not be interviewed concerning self-regulation factors in a meaningful way.

5.5 Outlook and outline of follow-up work

5.5.1 Matching the samples over time

In order to evaluate changes in behavior within the same persons over time it would have been necessary to sample the same subjects over time, interviewing them at repeated points of the project, namely before and after the interventions were implemented. This would allow to link responses from each subject to earlier surveys and could be used for a longitudinal anaylisis of the data. Technically this is necessary to draw conclusions on the effectiveness of any interventions and would allow to judge the timely causality in the mediation analysis on the campaign mechanisms.

5.5.2 Multiple measuring points

Further, a more frequent sampling of individual households over time would allow to monitor change over time within individuals and households. Such an approach could reveal more fine-grained internal mechanism of behavior change over the course of time e.g. what steps are happening within one person choosing to adopt, maintain or stop treating their drinking water. Using several follow-up measurements of the target behavior, change in behavior as well as in psychological factors could help to reveal the dynamics of change over time. Especially the fact that normative factors within the community and families showed to play such an important role for behavior change in the presented samples, following individuals' decision in regard to others' behavior could help to understand these social dynamic processes.

5.5.3 Long-term evaluation

Further, a long-term evaluation of the implemented campaign could reveal its efficacy in leading to sustained behavior change above the course of the presented work. Here, it was only possible to estimate the effects of the campaign at one moment in time, shortly after the interventions were implemented.

5.5.4 Testing individual intervention elements

On a practical level, it would be valuable to refine and re-apply the same intervention approach depicted in Study 3 in a similar setting. Two things seem worthwhile here: Investing in strengthening the capacity for implementation and running a long-term evaluation.

In light of the mixed results of the mediation analysis in Study 3, it would be of great value to be able to test and evaluate the different elements of the campaign on an individual basis. This would imply using the same strategies, however disaggregating the intervention elements and implementing them in different intervention arms. This could be done either by implementing one element in one group at a time or using different combinations, adding one element to the previous one across different groups. This would allow to individually estimate the singular or additive effects of the individual elements on the target behavior. The results of such an

approach could help to further refine the campaign approach and to test which elements worked well and which ones would need to be revised again. Unfortunately, such an approach was not possible within the described project given constraints of the study design set by different project stakeholders involved in the international collaboration.

5.5.5 Testing different mode of intervention delivery

An improved communication strategy could help to guarantee that the intervention be delivered to the targeted subjects. This would be possible choosing other communication channels than the ones used during the implementation of the presented campaign. One idea would be the diffusion of intervention contents via mass media. As it is the case in the given setting, radio is the most widely used and received mass media available. Emitting parts of the campaign contents via radio broadcasts was an initial idea formulated after the baseline research had been carried out. Expectedly, more people would have been reached during the campaign, if only by a possibly lower dose. However, this idea contradicted the planned design of a randomized allocation of interventions over the study communities and was therefore abandoned. One of the most important reason to choose community meetings as a primary means of transporting the campaign information to the target audience was the established importance of social norms for drinking water chlorination. The meetings set the basis to implemented some of the selected behavior change techniques such as the public commitment element, which would not have been possible within the other communication channels discussed.

However, it would be interesting to test the diffusion of the intervention contents via mass media in one study area and compare it against the effects that were reached using the face-to-face communication strategies used during the evaluated campaign. In terms of cost-efficiency of different communication channels by comparing the number of people reached and the effects achieved within the affected beneficiaries.

5.5.6 Testing in times of risks for epidemics

Given the background of the study project – disease prevention in high risk settings for cholera outbreaks – it would be of special interest to study the populations' mindset regarding hygiene prevention behaviors such as drinking water treatment in light of occurring or threatening epidemics. As has been stated previously, there have been findings that prevention behaviors increase during outbreaks such as has been the case with handwashing during cholera epidemics in several countries (Curtis, Danquah, & Aunger, 2009). This finding was not supported by the evidence from the presented studies, at least there was no difference in the chlorination rates between times of dry season and wet season which is linked to higher threat of outbreaks. In this regard, it would be of interest to study what the population thinks and does in terms of drinking water treatment during actual outbreaks. This is however not easily feasible as these are not well foreseeable and projects are usually limited in terms of time and funds available for field research. Further, during times of acute cholera epidemics, access to affected regions might be limited and research not necessarily a priority over first aid interventions. In addition, running an experiment with waiting control groups can be ethically problematic under acute threat.

However, once an intervention strategy is well implemented into the health system and can easily reproduced once an outbreak is detected, its effects could be

measured if it is implemented e.g. in some regions earlier than others. Also, if interventions could be linked to a short assessment of psychological variables in intervention beneficiaries, this could at least serve as a rough orientation in understanding mindsets in times of acute threat.

5.6 General conclusions

Although simple technological solutions are available to render water safe for drinking at the household level, several millions of people worldwide still use water that is inadequate for consumption posing them at a high risks of cholera infections and other diarrheal diseases. This represents a major gap reaching the United Nations Sustainable Development Goals related to access to safe drinking water around the globe. Behavior change towards the adoption and continued usage of safe drinking water options represent a huge potential in ameliorating the health situation of large parts of the world population. This thesis helps to foster the understanding of underlying socio-psychological factors leading to sustainable drinking water treatment behavior.

This work presents the findings from several field studies assessing relevant socio-psychological factors for the uptake and continued application of household drinking water chlorination as a preventative measure to avoid the spread of future cholera outbreaks in the Lake Chad basin region. Further, it describes the effects and psychological mechanisms of a behavior change campaign, comprising several successfully applied behavior change techniques promoting the uptake of chlorination behavior within the study population. By revealing the campaign's underlying mechanisms of behavior change, it is demonstrated which elements of the proposed interventions were successful in changing peoples' mindsets in favor of drinking water treatment, and which elements would have to be refined in future applications.

The most relevant factors for initial uptake of chlorination behavior were found to lie within the social norm component including others peoples' behavior, social support, and social discourse, and the ability component, of the underlying RANAS model, and to some extent in the risk component. Looking at which factors are important for behavioral continuation of drinking water chlorination over time, again, norm factors such as the perception of others' behavior, personal obligation, and social support and discourse, and also perceived self-efficacy convictions were important, but also action control and peoples' intention to chlorinate. The implemented behavior change campaign successfully augmented the rate of chlorination among its participants by increasing their health knowledge, perceived others' behavior, social support, action knowledge, and perceived self-efficacy.

Hopefully, the presented findings and materials encourage people working in the development context to apply a structured, theory-based, and informed approach into their field work when trying to promote and foster simple, yet effective health relevant behaviors such as drinking water treatment to improve the population's health situation. The detailed description of the successfully tested behavior change interventions can be used as a basis for interventions in similar settings and might inspire involved aid workers to orient themselves using the presented campaign. For a more general approach in promoting the uptake and usage of various safe water options, a preliminary framework is presented depicting a collection of important psychological factors to be considered and how they influence individual behavior.

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Appendix A

Manuel de formation des Promoteurs

Mars 2015

REPUBLIQUE DU TCHAD
MINISTERE DE LA SANTE PUBLIQUE
DIVISON HYGIENE DU MILIEU ET ASSAINISSEMENT

Projet Eau – Assainissement – Hygiène pour la Prévention et le contrôle du Choléra au Tchad et au Cameroun
Stratégies de changement de comportement pour la promotion du traitement de l'eau destinée à la boisson

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Assisté par : Rassem Edmond CSSI; N'Djaména; Tchad

Table de matières

Introduction

Dans le cadre du projet Eau – Assainissement – Hygiène pour la prévention et lutte contre le choléra au Tchad et au Cameroun, des stratégies d'intervention pour le changement de comportement seront testées afin de promouvoir le traitement de l'eau ménagère et le lavage des mains aux moments clés dans des communautés pilotes dans le bassin du Lac Tchad. Les tâches des promoteurs seront de mettre en œuvre les interventions de changement de comportement au niveau de communautés sélectionnées dans la zone de recherche.

Ce manuel décrit en bref les résultats de l'enquête de référence avec les stratégies proposées ainsi que la démarche et les instructions à suivre par les promoteurs pour le déroulement des interventions au niveau des communautés cibles.

Objectifs des interventions

Les objectives de l'intervention sont les suivantes:

- Renforcer la sensibilisation de la population sur les risques des maladies diarrhéiques comme le choléra et ses voies de transmission
- Promouvoir l'utilisation régulière du chlore en liquide (eau de javel) pour le traitement de l'eau destinée à la boisson au niveau des ménages
- Promouvoir la construction d'une station/dispositif de lavage des mains dans les ménages
- Augmenter la fréquence de lavage des mains aux moments clés, principalement après le contact avec les selles et avant la manipulation des aliments et de l'eau de boisson.

L'ensemble des interventions proposées sera testé dans différents localités du projet avant d'être diffusé dans toutes les zones qui servent comme « sites témoins ». Les personnes ciblées seront les habitants des ménages enquêtés pendant l'étude de base, mais des membres provenant des ménages voisins seront néanmoins inclus dans les interventions.

Les interventions comporteront deux composantes : Composante 1 est une Campagne d'Information et Promotion qui sert principalement à l'éducation de la population sur les risques liés à l'eau insalubre et les mains sales comme mode de transmission pour les maladies diarrhéiques y compris le choléra. Composante 2 est une promesse qui se fait en réunion publique par les participants afin d'augmenter l'engagement individuel ainsi que les normes sociales favorables pour les bonnes pratiques d'hygiène.

Instructions pour les promoteurs - Responsables des Relais Communautaires

Préparations avant la séance

1. Cherchez un endroit idéal dans la localité pour la séance publique.
2. Se rencontrez avec les chefs de quartiers, les leaders communautaires pour leur informer sur l'activité.
3. Faites le tour dans la localité et invitez les participants ciblés (les participants de l'enquête de base selon la liste présentée) et des voisins. Indiquez l'endroit, la date et l'heure de la séance (s'il s'agit d'une grande localité, vous devriez faire plusieurs séances dans les différents quartiers (20 à 30 ménages par séance)).
4. Communiquez les dates, l'heure et le lieu aux moniteurs du CSSI pour qu'ils puissent vous visiter et assister.

Staff opérationnel

2 promoteurs, membres du Relai communautaire
1 moniteur du CSSI

Matériel

Ce manuel avec les instructions pour les réunions Spot et posters informationnelles Matériaux et matériel de démonstration Liste des participants à remplir pendant la séance avec collecte d'engagement public Signes d'engagement public à distribuer

Tâches des promoteurs

Promoteur 1 : assurer l'animation de la séance
Promoteur 2 : appuyer l'animation de la séance; remplir les listes des participants; distribuer les signes d'engagement

Durée

1h30mn à 2 heures par séance (selon la taille du groupe)
8-12 séances au total pendant 2-3 mois (au moins une séance par semaine)

Lieu

Un endroit central au niveau du voisinage capable de contenir le nombre des participants

Nombre de participantes

20-30 ménages participants par séance proposée

Points à retenir

Il est très important que le plan d'intervention soit respecté !
Aucune autre intervention ne sera remise aux participants !

Déroulement de la séance

1. Tous les participants sont réunis dans une salle de réunion (ou une place indiquée). Tout le monde est assis de manière que chacun peut voir tous les autres participants dans un cercle.

2. Les participants s'identifient; leurs noms seront notés dans une liste des participants. S'il manque des participants qui font partie de l'étude, il sera nécessaire de les contacter et leur demander de rejoindre la séance prochaine.

3. Introduction: Les Responsables de Relai communautaire souhaiteront la bienvenue aux participants au nom de tous les partenaires du projet, et leur remercieront d'être venus. Les promoteurs se présentent aussi et expliquent le but de la réunion.

4. Session informationnelle sur le rôle important du traitement de l'eau pour la prévention des maladies diarrhéiques et le choléra. (Durée: app. 30 minutes) D'abord, des informations seront présentées concernant le rôle de l'eau comme source de contamination avec des agents pathogènes des maladies diarrhéiques. La campagne préenregistrée sera présentée aux participants afin de les sensibiliser à la thématique.

   Matériel : Campagne préenregistrée (Composante 1A)
   Le traitement de l'eau avec le chlore sera proposé comme méthode de se protéger par le fait de rendre l'eau sûre pour la consommation et le stockage. Il est important d'expliquer aux participants les différents bénéfices du traitement régulier de l'eau destinée à la boisson afin d'éviter les maladies.

   Matériel : Poster d'information
   Après, des informations sur les produits de chlore local peuvent être donné, par exemple le prix, où on peut l'acheter, et le dosage correct et le temps de latence (temps où le produit agit). Du temps supplémentaire doit être planifié pour répondre aux questions des participants après la présentation.

5. Engagement public (Composante 2A) (Durée: app. 45 minutes)
   Maintenant le groupe des participants sera demandé de faire une promesse de s'engager à :

   - Commencer de faire le traitement régulier de l'eau destinée à la consommation dans le ménage et
   - Commencer de supporter la personne responsable du traitement de l'eau par l'achat du matériel nécessaire et l'encourager dans ses efforts de faire le traitement régulier de l'eau de boisson.

   Les personnes qui promettent seront demandées de lever les mains (ou de faire un geste approprié) pour démontrer leur engagement. Les noms des personnes engagées seront notés sur la liste des participants.

   Tous les membres engagés reçoivent un signe d'engagement et sont priés de l'afficher sur une place dans leur maison afin qu'il soit visible de l'extérieur. Sa fonction est de leur rappeler à eux-mêmes leur engagement pris lors de la réunion et de démontrer leur engagement aux autres.

6. Démonstration de l'utilisation du chlore et son dosage

   Ensemble avec les participants, un récipient de stockage de l'eau sera recherché dans un ménage proche, son volume sera estimé, et ainsi le dosage correct sera appliqué. Le temps d'attente (30 min) devrait être expliqué avant que l'eau soit sûre à la consommation et son goût peut être expliqué comme signe de qualité de l'eau. Les participants peuvent gouter l'eau s'ils le veulent.

7. Fin: Tous les participants seront remerciés pour leur participation et la réunion sera fermée.

Point à retenir: L'objectif visé est d'amener les ménages à sentir la nécessité de faire régulièrement le traitement de l'eau ménagère destinée à la boisson. L'idée est d'utiliser principalement le matériel et le produit déjà disponible sur le marché (eau de javel) et que la participante (le ménage) l'achète elle-même (lui-même).

Description du poster d'information

Ce poster vous aide à expliquer les sources et les voies de transmission du choléra et des autres maladies diarrhéiques ainsi que les gestes d'hygiène qui peuvent protéger contre ce genre de maladies hydrique comme le traitement de l'eau et le lavage des mains dans les situations clés, cet-à-dire après tout contact avec des selles et avant de manger ou préparer la nourriture.

En haut :

Il s'agit du schémas qui explique les sources et voies des transmissions du choléra et les autres maladies diarrhéiques d'origine hydrique. Le choléra comme des autres maladies diarrhéiques sont des maladies qui se transmettent de manière fécaux-orale, ce qui signifie que les agents pathogènes sont diffusés par les selles et entrent dans l'organisme par la voie orale. À gauche on voit les sources des pathogènes qui sont propagé par la défécation à l'aire libre qui est encore beaucoup pratiqué au Tchad. Les selles qui ne sont pas couvert à l'aire libre peuvent contaminer l'environnement de la nature comme les sources d'eau ouvertes (fleuve, lac, étang) et propager les agents pathogènes. Mais le cholera ne se trouve pas seulement dans les selles, depuis des dizaines d'années cette maladie est endémique au Tchad, ça veut dire qu'il est présente partout dans la nature, dans les eaux, dans le sol, les champs, et ailleurs dans l'environnement. Le risque d'attraper le choléra est très haut lorsqu'une épi-démie est arrivée, mais le risque pendant les périodes silencieuses et ainsi élevé pour tous les maladies diarrhéiques comme a montré une étude d'EAWAG en collaboration avec le Ministère de la santé et l'OMS.

Après les sources naturelles, la maladie est propagée par les mains sales ou mal lavées. Nous avons toujours contact avec des possible sources de contamination soit quand on utilise les latrines mais aussi en saluant les personnes ou en touchant les objets souillés. Les agents pathogènes se trouvent partout dans notre environnement et se diffusent par notre mains en touchant des objets et en se saluant par contact des mains. C'est par les mains aussi qu'on peut propager les agents de la maladies dans la nourriture et le eau stocké.

Soit directement par le contact avec le visage ou la bouche, soit par touchant la nourriture ou l'eau, les mains sales ou mal-lavées aident à introduire les agents pathogènes dans le corps. Une autre voie de transmission principale sont les eaux destinées à la boisson et à préparer la nourriture. Soit des sources non-protégées comme les puits ouverts, les vendeurs d'eau et l'eau du fleuve, mais aussi des sources améliorées comme les forages ou le robinet ne sont pas toujours sûrs pour la consommation. Il existe une quantité des sources de ré-contamination même si l'eau était de bonne qualité au niveau de la source, pendant son transport, son stockage, et son utilisation. Le gobelet, par exemple est souvent plongé avec la main – qui aussi peut être contaminée – dans l'eau stocké dans la jar par exemple, ce qui représente une possible source de ré-contamination.

En bas :

Le deuxième schémas qui est de la même structure illustre comment on peut se protéger contre le choléra et les autres maladies diarrhéiques. Ils existent des mesures très simples mais efficaces pour éviter d'attraper la maladie. En autre, il s'agit de deux simple gestes d'hygiène, le traitement de l'eau (avec l'eau de javel) et le lavage

des mains régulière avec de l'eau et du savon dans les situations clés de la vie quotidienne. Il est à démontrer comment ces gestes peuvent couper les voies de transmission.

Utilisation des latrines

En utilisant toujours les latrines quand il est possible on peut déjà réduire le taux de la pollution de l'environnement et des sources d'eaux avec les selles qui contiennent des microbes. En même temps, le risque de propagation des microbes dans les eaux et avec ça le risque de contamination pour la communauté et déjà réduit.

Lavage des mains

Un des principes les plus importants et efficaces pour se protéger contre le choléra comme les maladies diarrhéiques est le lavage des mains avec de l'eau et du savon dans les moments clés. Il s'agit des situations après tout contact avec des selles (en sortant de la latrine, après avoir nettoyer un enfant et avant de manger ainsi qu'avant de préparer et toucher la nourriture). L'agent effectif ici, c'est le savon (en pièce, en liquide, de l'omo) qui peut tuer les microbes sur le peau. L'eau simple n'arrive pas à cet effet.

Utilisation des sources protégées

En outre, par l'utilisation des sources d'eau primaires améliorées comme les forages et les robinets on réduit le risque de se contaminer avec des eaux sales et chargés des microbes. Les sources protégées généralement sont d'une meilleure qualité comparées aux sources non-protégées comme les puits ouvertes, l'eau du fleuve ou des lacs et l'eau qui est délivrée par les vendeurs. Tout-de-même on ne sait jamais de la qualité de ces eaux.

Traitement de l'eau

Pour couper le voie de transmission par l'eau ménagère il existent plusieurs possibilités de rendre cette eau sûre à la consommation. En ajoutant le propre dosage d'eau de javel, on tue tous les microbes pathogènes dans l'eau de toute les sources qui normalement transmettent les maladies diarrhéiques. En utilisant seulement cette eau traitée pour la consommation ainsi que pour la préparation de la nourriture, on peut s'assurer d'éviter l'ingestion des microbes, car ils étaient tués par l'eau de javel. Son goût et son odeur de chlore sont des signes de qualité de cette eau qui était préparée pour la consommation sécurisée.

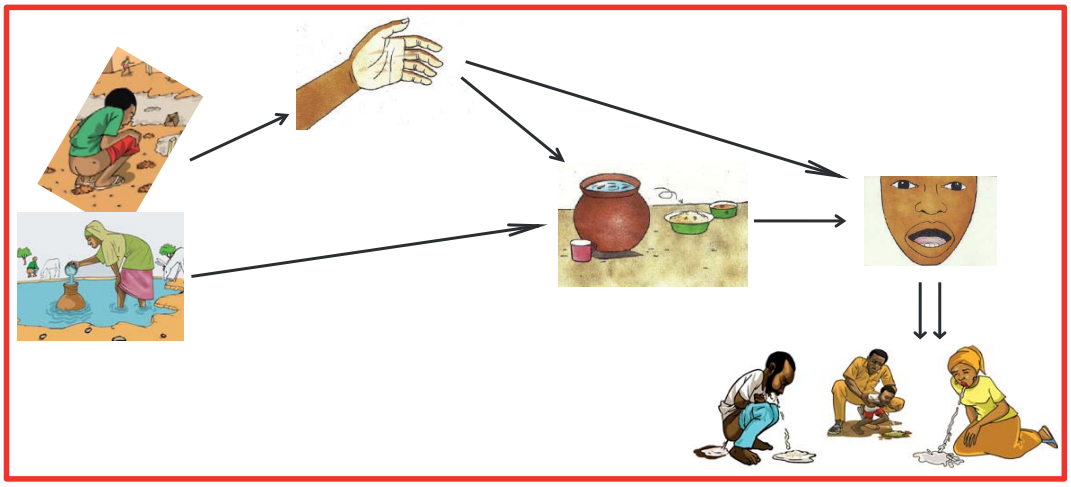
REPUBLIQUE DU TCHAD
MINISTERE DE LA SANTE PUBLIQUE
DIVISON HYGIENE DU MILIEU ET ASSAINISSEMENT

Unité – Travail – Progrès

Organisation Mondiale de la Santé

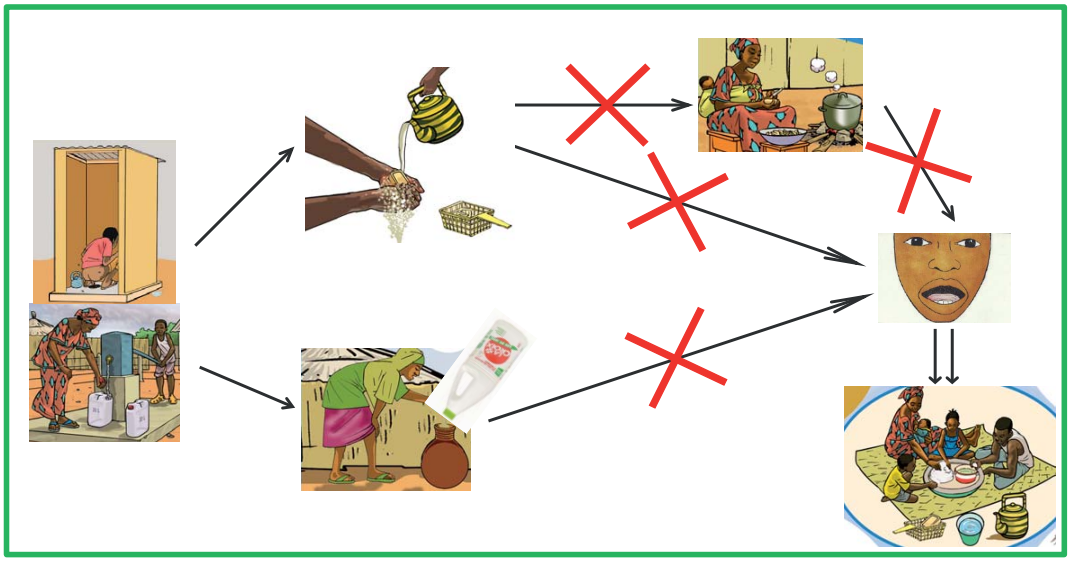
VOIES DE TRANSMISSION DU **CHOLÉRA**

Comment je peux attraper le choléra et les maladies diarrhéiques d'origine d'eau?



ET COMMENT SE PROTEGER

Qu'est que je peux faire pour éviter le choléra et son propagation?



Ensemble protegons nous et nos enfants contre le choléra
par les bonnes pratiques d'hygiène!

Projet EAU - ASSAINISSEMENT - HYGIÈNE pour la
Prévention et lutte contre le Choléra au Tchad et au Cameroun

eawag aquatic research

FIGURE A.1: Informational poster used during the interventions

Appendix B

Intervention element – Spot d'Information et Promotion du traitement de l'eau

Introduction

"Tenez, le choléra est une maladie de nature épidémique parmi le groupe des maladies diarrhéiques. Il représente un danger potentiel permanent et non seulement pendant les flambées. Le choléra et les diarrhées ainsi que bien d'autres maladies sont transmis et se propagent par le moyen des eaux de qualité douteuse, telles que l'eau de la rivière, l'eau du puits ouvert, l'eau de la pompe ou du robinet souillée. Il y a donc un grand risque de contracter ces maladies si nous ne traitons pas l'eau destinée à boire et à la préparation de nos aliments. Le traitement de l'eau avec le chlore (sous forme d'eau de javel par exemple) est un moyen plus simple et très moins cher pour rendre les eaux de boisson potables. Ce qui garantit notre santé contre les maladies diarrhéiques et les maladies parasitaires qui ont leur origine dans l'eau. Une enquête conjointe a été effectuée en 2014 au sein d'un certain nombre de ménages au Tchad et nous vous invitons à suivre quelques déclarations des personnes enquêtées par rapport au traitement de leur eau de boisson."

Déclarations positifs et négatifs exemplaires

"Avant je ne savais pas que l'eau que nous buvons rend malade, surtout les maux de ventre, les diarrhées, les dysenteries etc. mais un jour, j'étais au centre de santé avec ma fille qui avait la diarrhée et l'infirmier nous a expliqué l'origine des maladies diarrhéiques et comment elles sont transmises à l'homme par l'eau de boisson dont on n'est pas sûr de sa potabilité. Il nous a dit que pour éviter ces maladies, nous devons mettre de l'eau de javel dans notre eau de boisson pour la rendre potable avant de la consommer. J'ai essayé cela et j'ai trouvé qu'il nous a dit la vérité. J'ai appris à mon épouse comment mettre de l'eau de javel dans l'eau de boisson. J'ai pris la décision de lui donner de l'argent pour acheter de l'eau de javel et d'en mettre toujours dans l'eau de boisson pour toute la famille chaque fois qu'elle remplit le récipient d'eau. J'ai conseillé à tous mes enfants de boire que de l'eau additionnée d'eau de javel. Le résultat est que tout le monde dans ma faille tombe très peu malade. La diarrhée a disparu de ma famille et l'argent que je dépensais pour acheter les médicaments contre la diarrhée me servent à faire d'autres choses pour ma famille."

"Il y a quelque temps, je ne savais rien sur le risque que l'eau insalubre impose sur ma santé et surtout sur la santé de mes enfants. Maintenant que je sais que c'est

un des moyens les plus importants de contracter la diarrhée et le choléra, je traite toujours l'eau que nous utilisons pour boire dans notre maison. Et je vois clairement que mes enfants sont en meilleure santé qu'ils ne l'étaient avant."

"Nous n'avons jamais traité notre eau potable à la maison, parce que nous ne savons pas comment le faire. Personne ne nous a dit avant quel est le produit à acheter et comment il faut le faire. Si nous savions où trouver le bon matériel et comment le faire, nous aurions probablement le faire. Mes enfants sont malades tant de fois, et ils sont toujours affaiblis, et je dois aller chercher et payer les médicaments pour eux."

"Avant, je ne savais pas comment faire le traitement de l'eau, mais je suis allé demander à l'infirmier de notre centre de santé de me l'expliquer. Maintenant le traitement de l'eau est facile pour nous : j'ajoute une certaine dose d'eau de javel dans le récipient chaque fois que je le remplis et elle la rend sûre à boire. Oh ! si vous pouvez sentir qu'elle est maintenant pure et potable."

"Si vous prenez l'eau de la rivière, vous ne savez jamais ce qui est là-dedans. Après tout, la rivière est passée dans d'autres villages, il y a beaucoup de saleté dedans. Donc, elle n'est pas très bonne à boire. Je dois la désinfecter en y ajoutant un peu de chlore."

"Nous n'avons pas le matériel à la maison donc je ne sais pas comment je devrais le faire."

"J'achète de l'eau de javel sur le marché local, la charge est environ la même que pour le sel et le sucre et elle rend l'eau potable pour ma famille pendant un mois entier. Certaines personnes disent que c'est trop cher et qu'elles n'ont pas d'argent pour cela. Mais quand vous pensez aux coûts pour acheter des médicaments chaque fois que vos enfants dans la famille tombent malades, c'est en fait pas autant d'argent."

"Nous n'ajoutons rien à notre eau potable, car on dit que l'eau des pompes ou l'eau des tuyaux est déjà bonne à boire. Cependant, nous ne savons pas vraiment si la qualité de ces eaux est bonne."

"Vous ne savez jamais. L'eau du système communautaire du robinet est censée être potable, mais nous n'avons pas trop de confiance toujours, parce que nos enfants souffrent encore assez souvent de diarrhée et je voudrais faire tout mon possible pour empêcher que mes enfants tombent malades. J'aime être du côté sécurité, et prendre la responsabilité pour le bien-être de mes enfants."

"Je traite mon eau potable pour éviter les maladies qui sont transportées par l'eau insalubre, comme la diarrhée et le choléra. Je veux être sûr que je ne tombe pas malade de l'eau que je bois dans ma maison."

"Quand j'ai beaucoup d'autres choses à faire parfois j'oublie, c'est pourquoi je ne traite pas notre eau potable régulièrement, mais un signe de rappel pouvait m'aider à me rappeler de le faire."

"Je sais que l'eau que nous prenons dans notre puits ouvert n'est pas très sûre de qualité potable. Tout le monde vient puiser son eau ici en plongeant les récipients

usagés dans le puits, parfois ces récipients trainent à terre et ramassent beaucoup de saleté. Aussi, les animaux sont généralement autour de la bouche du puits d'eau et ils boivent ici. Leurs excréments se retrouvent souvent dans le sol qui entoure la bouche du puits et même directement dans l'eau qui est dans le puits."

"J'aime l'odeur de l'eau chlorée. Elle me donne une sensation de fraîcheur et je sais que cette eau est bien potable. Nous traitons notre eau potable pour tuer les microbes et autres sources de maladies."

"Nous n'avons pas l'habitude de traiter notre eau potable. Je ne pense pas que ça vaut le coup et je suis trop occupé avec d'autres choses qu'à faire cet effort supplémentaire."

"Nous avons commencé à traiter notre eau potable tout récemment. Les gens de plus en plus le font maintenant dans notre quartier. Je pense que c'est important d'avoir de l'eau potable pour que mes enfants ne tombent pas malades et peuvent aller à l'école. Comme ça, ils sont capables de bien apprendre afin qu'ils réussissent à l'école et puissent gagner un peu d'argent plus tard pour soutenir notre famille. Lorsque mes enfants sont en bonne santé, je peux m'occuper de la maison et des travaux de la journée sans m'occuper d'eux."

"Pour moi, dès que j'ai écouté ces messages, j'ai décidé de ne boire exclusivement que de l'eau javellisée, et depuis lors je tombe rarement malade de diarrhée, de choléra, de maux de ventre etc."

"Un adage de chez nous dit : « On ne lave pas l'eau avant de la boire ! », cela suppose qu'il faut prendre soin de l'eau de boisson, c'est-à-dire l'eau à boire doit être toujours propre. Si on boit de l'eau sale, on tombera malade un jour, mais quand on tombe malade, on ignore que c'est l'eau sale qu'on a bu qui a rendu malade. Or, l'eau que nous buvons, même si elle est claire, elle peut contenir des substances dangereuses qui constituent des poisons pour l'organisme ; elle peut contenir également des microbes qui peuvent donner la maladie. Ces poisons et ces microbes ne se voient pas à l'œil nu dans l'eau. D'où, si on ne veut pas tomber malade à cause de ces poisons et microbes contenus dans l'eau de boisson, il faut traiter cette eau avant de la boire. L'eau de javel tue les microbes et détruit beaucoup de poisons. C'est pourquoi, il est recommandé d'ajouter de l'eau de javel à l'eau de boisson avant de la consommer. Ce qui garantit la santé de ceux qui boivent de l'eau javellisée."

Appendix C

Interview questions

Introduction

Bonjour, je m'appelle (nom interviewer) et je travaille pour le CSSI, Centre de Support en Santé Internationale en collaboration avec Eawag, l'Institut suisse de Recherche sur l'Eau. Nous menons, en collaboration avec l'Organisation Mondiale de la Santé et le Ministère de la Santé Publique, une enquête sur le comportement lié à l'eau, l'hygiène et l'assainissement familial. Nous etions chez vous dans l'année passée pour vous enquêter. Maintenant nous avons de nouveau besoin des informations par les ménages. En plus de votre localité, cette enquête se fait dans d'autres localités dans les districts de N'Djamena, Mandalia, Massaguet et le Mayo Kebbi Est.

Le but de cette enquête est de mieux connaître vos pratiques quotidiennes d'hygiène et d'assainissement. Avec votre participation vous pouvez nous aider à ameliorer la situation d'hygiène et d'assainissement au Tchad et les efforts de promotion d'hygiène par le Ministère de la Santé.

J'aimerais parler à la personne qui s'occupe des enfants et du ménage et qui nous à donner les informations dans la première enquête.

Enquêteurs: Attendez jusqu'à l'arrivée de la personne responsable des enfants, s'il ne s'agit pas de la personne avec qui vous êtes en train de parler! Si nécessaire, répétez votre introduction!

Si vous êtes d'accord, je voudrais bien vous poser quelques questions qui concernent l'hygiène et l'assainissement afin de connaitre vos attitudes et pensées concernant la situation d'hygiène et d'assainissement dans votre ménage ainsi que prendre quelques images. Notre entretien va durer une heure environ. Vous pouvez nous aider mieux si vous répondez le plus sincèrement et exactement possible. S'il vous plaît aidez-nous à comprendre quelle est la situation réelle!

La participation est sans risque. Nous vous interrogerons sur ce que vous pensez et faites pendant votre journée. Toutes les informations sont anonymes et confidentielles. La participation dans l'enquête est volontaire.

Enquêteurs: S'il vous plaît demander à la personne que vous êtes sur le point d'interroger au sujet de son autorisation de procéder à l'entretien. Si le consentement n'est pas donné, remercier la personne pour son temps et rechercher le ménage prochain conformément à la procédure.

Questionnaire

SVP, entrez le ID ménage ici.

Enquêteur: SVP, vérifier bien avec votre superviseur le ID du ménage correct!

Est-ce le ménage pouvait être retrouvé?

0 Non
1 Oui

Si non, pourquoi pas?

Est-ce le ménage peut être interviewé?

0 Non
1 Oui

Si non, pourquoi pas?

La personne, elle a donné son accord à être interrogé?

Enquêteur: si NON, ne continuez pas, cherchez le prochain ménage.
0 Non
1 Oui

Pourquoi pas? Quelles sont les raisons?

SVP remplissez avant l'interview

Date de l'interview

Nom de l'enquêteur

Nom du pays

1 Tchad

Nom du district

1 District de N'Djamena Est
2 District de N'Djamena Nord
3 District de N'Djamena Sud
4 District de Mandalia
5 District de Massaguet
6 District de Bongor
7 District de Guelendeng
9 autre
SVP spécifier autre.

Nom de l'aire de responsabilité

1 Mandalia
2 Koundoul
3 Logone Gana
4 Diguel
5 Milezi
6 Chagua
7 Walia
8 Massaguet

9 autre
11 Bongor 1
12 Bongor 2
13 Bongor 3
14 Bongor 4
15 Bongor 5
16 Bongor 6
17 Guelendeng 1
18 Guelendeng 2
19 Guelendeng 3
20 Guelendeng 4
SVP spécifier autre.

Langue parlée durant l'interview

1 Arabe
2 Français
3 Sara
4 Ngambaye
5 Masa
9 autre
SVP specifier autre.

Informations générales

La section suivante vous demande quelques informations générales sur vous et votre ménage: Veuillez répondre à toutes les questions aussi correctement que possible. Si vous ne voulez pas répondre à une question, s'il vous plaît informer l'interviewer.

Quel est votre nom?

Quelle est votre âge?

SVP choisir sexe.

1 féminin
2 masculin

Quel est le nom du chef du ménage?

Quelle est votre relation avec le chef de ménage?

1 épouse
2 fille
3 mère
4 soeur
5 fils
6 père
7 frère
8 chef du ménage
9 autre
SVP specifier autre.

Quelle est votre statut matrimonial?

1 marié
2 célibataire
3 veuf
4 concubine
5 divorcé
9 autre
SVP specifier autre.

Quelle est votre relation avec l'enfant de moins de 5 ans?

1 mère
2 soeur
3 grand-mère
4 tante
5 frère
6 grand-père
7 oncle
8 père
9 autre
SVP specifier autre.

Combien de personnes vivent dans votre ménage…de moins de 5 ans?

Combien de personnes vivent dans votre ménage…entre 5 et 17 ans?

Combien de personnes vivent dans votre ménage…de plus de 18 ans?

Combien de personnes vivent dans votre ménage…en total?

Quelle est votre confession religieuse?

1 musulman
2 catholique
3 protestant
4 animiste
9 autre
SVP specifier autre.

Pouvez-vous lire et écrire en Francais ou Arabe?

1 Oui, lire et écrire
2 seulement lire
3 seulement écrire
4 Non

Quelle est le niveau d'étude le plus haut que vous avez terminé?

1 pas scholarisé
2 école coranique
3 école primaire
4 école secondaire

5 école supérieure
9 autre

Quel est le mode d'emploi du chef de ménage?

1 agriculture
2 élevage
3 commerce
4 pêcheur
5 autre travail indépendant
6 employé avec contrat
7 employé sans contrat
8 travailleur journalier
12 militaire/police
13 etudiant
10 appauvri
11 retiré
9 autre
SVP specifier autre.

Combien de fois est-ce que vous... écoutez la radio?

1 jamais
2 plusieurs fois par an
3 plusieurs fois par mois
4 plusieurs fois par semaine
5 presque tous les jours

Combien de fois est-ce que vous... regardez la télé?

1 jamais
2 plusieurs fois par an
3 plusieurs fois par mois
4 plusieurs fois par semaine
5 presque tous les jours

Combien de fois est-ce que vous... rencontrez vous avec les gens de la communauté?

1 jamais
2 plusieurs fois par an
3 plusieurs fois par mois
4 plusieurs fois par semaine
5 presque tous les jours

Pouvez-vous nous donner un numéro de téléphone où on peut vous contacter dans le future?

Usage de l'eau

Nous aimerions savoir certaines choses au sujet de votre consommation d'eau personnelle. Je vais vous poser des questions au sujet de votre collecte quotidienne de

l'eau, le stockage, le traitement et la consommation. Encore une fois, s'il vous plaît essayer de répondre à chaque question aussi précisement que possible. Vous n'avez pas à répondre si vous ne le voulez pas, mais il serait extrêmement utile pour nous, si vous répondez aussi honnêtement que possible.

De quelle type de source vous obteniez normalement votre eau destinée à la boisson?

Enquêteur : C'est une question ouverte! NE lisez PAS les réponses! Marquez seulement ce qui est mentionné par la personne. Plusieurs réponses possibles.
1 source ouverte fleuve/lac
2 étang
3 puit traditionel ouvert
4 puit traditionel fermé
5 source naturelle
6 fourrage pompage manuel
7 fourrage pompage électrique
8 vendeur de l'eau/camion
10 eau de bouteille
11 robinet
12 eaux de pluie
9 autre
SVP spécifiez autre.

Quelle est la distance du ménage jusqu'à la source de l'eau?

1 se trouve dans le ménage
2 jusqu'à 50 m du ménage
3 50-250 m du ménage
4 250-500 m du ménage
5 500-1000 m du ménage
6 plus que 1 km du ménage

Combien de temps ça vous prend d'y aller, attendre, remplir le récipient et revenir?

1 moins qu'une minute
2 1-5 minutes
3 5-15 minutes
4 15-30 minutes
5 30-60 minutes
6 plus qu'une heure

Combien est-ce vous payez pour l'eau par semaine? (CFA)

SVP pouvez-vous me montrer le récipipent que vous utilisez pour aller chercher de l'eau?

Enquêteur: SVP faites une photo du récipient.

Enquêteur: SVP, estimez la taille du récipient en litre.

1 1 litre
2 5 litres
3 10 litres
4 20 litres
5 30 litres
9 autre
SVP spécifiez autre.

Combien de fois remplissez-vous ce récipient par jour?

L'eau de cette source, est-il sûre à la boison?

0 Non
1 Oui
3 ne sais pas

Traitement de l'eau

SVP, racontez nous de vos practiques actuelles du traitement de l'eau.

Connaissez-vous des manières de faire l'eau plus sûre à boire?

Enquêteur : C'est une question ouverte! NE lisez PAS les réponses! Marquez seulement ce qui est mentionné par la personne. Plusieurs réponses possibles.
0 rien
1 laisser tranquille
2 faire bouillir
3 chlore
4 eau de javel (chlore liquide)
5 tablettes de chlore
6 désinfection solaire
7 filtre de tissu
8 filtre ceramique
11 filtre de sable bio-active
12 PUR
9 autre
10 ne sais pas
SVP spécifiez autre.

Pouvez-vous m'offrir une tasse de l'eau destinée à la boison pour les enfants chez vous?

0 Non
1 Oui
3 pas disponible

Enquêteur SVP observez: Est-ce que l'eau a été recolté d'une manière sûre (sans l'avoir touché avec les mains et dans une récipient propre)?

0 Non
1 Oui

L'eau a été prise de quelle type de source?

1 source ouverte fleuve/lac
2 étang
3 puit traditionel ouvert
4 puit traditionel fermé
5 source naturelle
6 fourrage pompage manuel
7 fourrage pompage électrique
8 vendeur de l'eau/camion
10 eau de bouteille
11 robinet
12 eaux de pluie
9 autre
SVP spécifiez autre.

SVP pouvez-vous me montrer le récipipent que vous utilisez pour stocker l'eau destinée à la boison?

1 bidon ouvert
2 bidon fermé
3 bidon fermé avec robinet
4 jerry can
5 jar ceramique
6 gallon jug
7 bassin
9 autre
10 pas vue
SVP spécifiez autre.

Enquêteur: SVP estimez: est-ce que le récipient est propre?

0 Non
1 Oui
3 ne sais pas

Est-ce que vous faites quelque chose pour rendre l'eau plus sûre à boire?

0 Non
1 Oui
3 ne sais pas

Pourquoi pas?

Enquêteur : C'est une question ouverte! NE lisez PAS les réponses! Marquez seulement ce qui est mentionné par la personne. Plusieurs réponses possibles.

1 manque des moyens financiers
2 manque des materiels (eau de javel)
3 manque de temps
4 oublié
9 autre
10 ne sais pas
SVP spécifiez autre.

Pourquoi est-ce que vous faites l'eau plus sûre?

Enquêteur : C'est une question ouverte! NE lisez PAS les réponses! Marquez seulement ce qui est mentionné par la personne. Plusieurs réponses possibles.
1 éviter les maladies
2 pour la santé
3 tuer les microbes
4 rendre l'eau propre
5 risque de diarrhée
6 epidemie de choléra
9 autre
10 ne sais pas
SVP spécifiez autre.

Comment est-ce que vous traitez l'eau destinée à la boison?

Enquêteur : C'est une question ouverte! NE lisez PAS les réponses! Marquez seulement ce qui est mentionné par la personne. Plusieurs réponses possibles.
0 rien
1 laisser tranquille
2 faire bouillir
3 chlore
4 eau de javel (chlore liquide)
5 tablettes de chlore
6 désinfection solaire
7 filtre de tissu
8 filtre ceramique
11 filtre de sable bio-active
12 PUR
9 autre
10 ne sais pas
SVP spécifiez autre.

Combien de temps traitez-vous l'eau destinée à la boison?

1 jamais
2 rarement (s'il y a des visituers par exemple)
3 quelquefois
4 souvent
5 toujours
6 ne sais pas

Est-ce que vous avez du materiel pour traiter l'eau à la maison en ce moment? Vous pouvez me montrer, SVP?

0 Non
1 Oui

Enquêteur: Observez: Est-ce que le produit semble être en cours d'utilisation?

1 semble d'être utilisé régulièrement
2 ne semble pas d'être utilisé
3 vide
4 pas disponible

Enquêteur: SVP prendre une photo du matériel.

Combien d'argent dépensez-vous pour traiter l'eau par semaine? (CFA)

Vous avez dites que vous traitez votre eau destinée à la boison à une manière spécifique. Maintenant nous sommes intéressés de vos attitudes et pensées sur le traitement de l'eau de la manière que vous faites d'habitude. SVP essayez à répondre aux questions suivantes./ Vous avez dites que vous ne traitez pas votre eau destinée à la boisin. Nous sommes quand même interessé de vos attitudes et pensée sur le traitement d'eau en général. Alors, SVP imaginez vous, si vous voulez traiter votre eau destinée à la boisin, qu'est-ce qui vous en pensez et essayez de répondre aux questions suivantes.

Dans quelle mesure pensez-vous que c'est laboureux de toujours traiter l'eau?

1 pas du tout laborieux
2 un peu laborieux
3 moyennement laborieux
4 assez laborieux
5 très laborieux

Dans quelle mesure pensez-vous qu'il faut du temps pour traiter de l'eau?

1 pas du tout de temps
2 un peu de temps
3 moyennement de temps
4 assez de temps
5 beaucoup de temps

Dans quelle mesure trouvez-vous cher de traiter l'eau?

1 pas du tout cher
2 un peu cher
3 moyennement cher
4 assez cher
5 très cher

Dans quelle mesure êtes-vous certain que traiter l'eau peut protéger vous et votre famille de la diarrhée?

1 pas du tout certain
2 un peu certain
3 moyennement certain
4 assez certain
5 très certain

Dans quelle mesure aimez-vous ou n'aimez-vous pas le goût de l'eau traitée?

1 ne l'aime pas du tout
2 ne l'aime pas assez
3 neutre
4 l'aime assez
5 l'aime beaucoup

Dans quelle mesure aimez-vous ou n'aimez-vous pas le goût de l'eau non traitée?

1 ne l'aime pas du tout
2 ne l'aime pas assez
3 neutre
4 l'aime assez
5 l'aime beaucoup

Dans quelle mesure pensez-vous que ne traiter pas l'eau peut risquer la santé de votre enfant?

1 pas du tout
2 un peu
3 moyen
4 assez
5 beaucoup

Dans quelle mesure pensez-vous que ne traiter pas l'eau peut risquer la santé de votre enfant pendant une épidémie de choléra?

1 pas du tout
2 un peu
3 moyen
4 assez
5 beaucoup

Si vous pensez au coûtes et bénéfices, pensez-vous qu'il y a de la valeur à traiter l'eau?

1 pas du tout de valeur
2 un peu de valeur
3 moyennement de valeur
4 assez de valeur
5 beaucoup de valeur

Si vous pensez au coûtes et bénéfices, pensez-vous qu'il y a de la valeur à traiter l'eau pendant une épidémie de choléra?

1 pas du tout de valeur
2 un peu de valeur
3 moyennement de valeur
4 assez de valeur
5 beaucoup de valeur

Selon vous, combien de personnes de votre communauté traitent leur eau destinée à la boison?

1 (presque) personne
2 moins que la moitié des gens
3 la moitié des gens
4 plus que la moitié des gens
5 (presque) tout le monde
10 ne sais pas

Combien de personnes de votre grande famille et de vos amis traitent leur eau destinée à la boison?

1 (presque) personne
2 moins que la moitié des gens
3 la moitié des gens
4 plus que la moitié des gens
5 (presque) tout le monde
10 ne sais pas

Les gens qui sont importants dans la communauté (par exemple, chef de quartier, Blama, Imam, docteur, etc) dans quelle mesure promovent-ils le traitement de l'eau?

1 pas du tout
2 un peu
3 moyen
4 assez
5 beaucoup

Est-ce que vous sentez une obligation personnelle de traiter votre eau?

1 pas du tout
2 un peu
3 moyen
4 assez
5 beaucoup

Quand vous accueillez des visiteurs, dans quelle mesure est-il important pour vous d'être capable de servir de l'eau traitée?

1 pas du tout important
2 un peu important

3 moyennement important
4 assez important
5 très important

Dans quelle mesure le chef du ménage supporte-il votre famille à traiter votre eau?

1 pas du tout
2 un peu
3 moyen
4 assez
5 beaucoup

Dans quelle mesure supportez-vous comme chef du ménage votre famille à traiter votre eau?

1 pas du tout
2 un peu
3 moyen
4 assez
5 beaucoup

Encore une fois, nous sommes intéressés de vos pensées sur le traitement de l'eau. Si vous le faites déjà, répondez liée à votre comportement actuelle. Si vous ne traitez pas l'eau du tout, imaginez vous que vous voulez le faire et répondez d'une manière hypothetique.

Dans quelle mesure est-il ou serait-il difficile pour vous de traiter effectivement votre eau?

1 pas du tout difficile
2 un peu difficile
3 moyennement difficile
4 assez difficile
5 très difficile

Dans quelle mesure êtes-vous confiant d'être capable de traiter votre eau même s'il prend un certaine temps et des efforts de le faire?

1 pas du tout confiant
2 un peu confiant
3 moyennement confiant
4 assez confiant
5 très confiant

Dans quelle mesure êtes-vous confiant d'être capable de traiter votre eau même si vous n'avez pas envie de le faire en ce moment?

1 pas du tout confiant
2 un peu confiant
3 moyennement confiant
4 assez confiant
5 très confiant

Dans quelle mesure êtes-vous certain que vous serez toujours capable de traiter votre eau avant la consommation?

1 pas du tout certain
2 un peu certain
3 moyennement certain
4 assez certain
5 très certain

Dans quelle mesure êtes-vous sûre de vous d'être capable de continuer à traiter votre eau même si vous ne voyez pas un résultat directement?

1 pas du tout certain
2 un peu certain
3 moyennement certain
4 assez certain
5 très certain

Dans quelle mesure êtes-vous confiant d'être capable de continuer à traiter votre eau même si vous avez oublié de le faire pour un certain temps?

1 pas du tout confiant
2 un peu confiant
3 moyennement confiant
4 assez confiant
5 très confiant

Est-ce que vous avez l'intention de traiter votre eau regulièrement?

0 Non
1 Oui

Est-ce que vous avez des plans comment s'assurer que vous serez toujours capable de traiter votre eau? Expliquez moi, SVP.

Enquêteur : C'est une question ouverte! NE lisez PAS les réponses! Marquez seulement ce qui est mentionné par la personne. Plusieurs réponses possibles.
0 PAS de plan
1 QUI va le faire
2 QUOI est nécessaire
3 COMMENT c'est fait
4 OÙ il est fait
5 QUAND il est fait
6 COMBIEN DE FOIS il est fait

Votre intention de toujours trater votre eau, elle est de quel degré?

1 très faible
2 assez faible
3 ni faible ni fort
4 assez fort
5 très fort

Combien de temps vous vous êtes souvenue de votre intention de traiter votre eau destinée à la boison pendant la semaine passée?

1 jamais
2 rarement (une fois par mois)
3 quelquefois (une fois par semaine)
4 souvent (plusieurs fois per semaine)
5 tous les jours

Dans quelle mesure avez-vous essayé de faire attention à toujours traiter votre eau pendant les dernières 24 heures?

1 pas du tout
2 un peu
3 moyen
4 assez
5 beaucoup

Vous avez dit que vous traitez déjà votre eau ou que vous avez l'intention de le faire. SVP racontez nous des difficultés de le faire.

Est-ce qu'il y a des difficultés spécifique qui interfèrent ou peuvent interférer avec votre intention de traiter votre eau?

0 Non
1 Oui

Quels sont les difficultés spécifiques que vous voyez susceptible d'interférer avec votre intention de traiter votre eau?

Avez-vous un plan spécifique sur comment faire face à cettes difficultés? SVP, dites-moi comment régliez-vous ce problème?

Enquêteur: SVP jugez, s'il existe un plan comment faire face aux difficultés.
0 Non
1 Oui
3 ne sais pas

Dans quelle mesure est-il important pour vous de traiter votre eau?

1 pas du tout important
2 un peu important
3 moyennement important
4 assez important
5 très important

Dans quelle mesure ça vous dérange quand vous ne pouvez pas traiter votre eau même si vous vouliez le faire?

1 pas du tout
2 un peu
3 moyen

4 assez
5 beaucoup

Dans quelle mesure vous vous sentez dévouée de traiter votre eau?

1 pas du tout dévoué
2 un peu dévoué
3 moyennement dévoué
4 assez dévoué
5 très dévoué

Dans quelle mesure vous devez vous souvenir de traiter votre eau?

1 pas du tout
2 un peu
3 moyen
4 assez
5 beaucoup

Dans quelle mesure pensez-vous que traiter votre eau c'est quelque chose que vous faites depuis longtemps?

1 pas du tout
2 un peu
3 moyen
4 assez
5 beaucoup

Dans quelle mesure vous traitez votre eau plutôt automatiquement, sans en penser directement?

1 pas du tout automatiquement
2 un peu automatiquement
3 moyennement automatiquement
4 assez automatiquement
5 très automatiquement

Dans quelle mesure pensez-vous que traiter votre eau c'est quelque chose d'habitude pour vous?

1 pas du tout d'habitude
2 un peu d'habitude
3 moyennement d'habitude
4 assez d'habitude
5 très d'habitude

Combien de temps parlez-vous du traitement de l'eau avec d'autres gens?

1 jamais
2 plusieurs fois par an
3 plusieurs fois par mois

4 plusieurs fois par semaine
5 presque tous les jours

lavage des mains

Dans la section suivante je vais vous poser des questions sur l'hygiène personnelle. SVP répondez selon votre connaissance.

Comment nettoyez-vous habituellement vos mains?

0 pas du tout
1 eau seulement
2 cendre seulement
3 sable seulement
4 eau et savon
5 eau et cendre
6 eau et sable
9 autre
SVP specifier autre.

Avez-vous du savon pour le lavage des mains dans votre ménage?

0 Non
1 Oui

Où stockez-vous habituellement votre savon qui est en cours d'utilisation. Vous pouvez me montrer SVP?

Plusieurs réponses possibles.
1 à côté de la latrine
2 ou se lave les vaiselles
9 autre
10 ne sais pas
SVP specifier autre

Enquêteur: SVP prendre une image du savon.

Avez-vous un endroit désigné pour le lavage des mains?

Enquêteur: Oberservez s'il y a du savon à coté de l'endroit.
0 Non
1 Oui

Enquêteur: SVP prendre une photo de l'endroit pour se laver les mains.

Quand est-ce que vous vous lavez les mains habituellement?

Enquêteur : C'est une question ouverte! NE lisez PAS les réponses! Marquez seulement ce qui est mentionné par la personne. Plusieurs réponses possibles.
0 JAMAIS!
1 avant de manger
2 après avoir mangé

3 avant de préparer des aliments
4 après avoir défequé
5 après avoir utilisé la latrine
6 avant d'allaiter ou nourrir un enfant
7 après avoir allaité ou nourru un enfant
8 après la défécation et nettoyage de l'enfant
9 autre
SVP specifier autre.

Pourquoi vous nettoyez-vous vos mains?

Enquêteur : C'est une question ouverte! NE lisez PAS les réponses! Marquez seulement ce qui est mentionné par la personne. Plusieurs réponses possibles.
1 éviter les maladies
2 pour la santé
3 tuer les microbes
4 être propre
5 éviter la saleté
6 éviter l'odeur
9 autre
10 ne sais pas
SVP specifier autre.

Si jamais, pourquoi pas?

Enquêteur : C'est une question ouverte! NE lisez PAS les réponses! Marquez seulement ce qui est mentionné par la personne. Plusieurs réponses possibles.
1 manque d'eau
2 manque de savon
3 manque des moyens financiers
4 manque de temps
5 oublié
9 autre
10 ne sais pas
SVP specifier autre.

Maintenant, nous aimerions connaître votre comportement de se laver les mains comment vous l'exécutez réellement. Nous ne sommes pas intéressés à la façon dont il doit être fait, ou ce que d'autres personnes ou vous pensez qu'il devrait être fait, ni dans aucune de vos intentions pour l'avenir. Nous aimerions simplement savoir à quelle fréquence vous vous lavez les mains dans certaines situations pour le moment.

En général, combien de fois vous vous lavez les mains avec de l'eau et du savon?

1 jamais
2 rarement (une fois par semaine)
3 quelquefois (1-2 fois par jour)
4 souvent (2-5 fois par jour)
5 toujours (dans tous les situations cibles)

En général, combien de fois votre mari/épouse se lave les mains avec de l'eau et du savon?

1 jamais
2 rarement (une fois par semaine)
3 quelquefois (1-2 fois par jour)
4 souvent (2-5 fois par jour)
5 toujours (dans tous les situations cibles)

En général, combien de fois vos enfants se lavent les mains avec de l'eau et du savon?

1 jamais
2 rarement (une fois par semaine)
3 quelquefois (1-2 fois par jour)
4 souvent (2-5 fois par jour)
5 toujours (dans tous les situations cibles)

Avant de cuire, couper ou préparer les aliments, combien de fois vous vous lavez les mains avec de l'eau et du savon?

1 jamais
2 rarement (une fois par semaine)
3 quelquefois (1-2 fois par jour)
4 souvent (2-5 fois par jour)
5 toujours (dans tous les situations cibles)

Avant de manger, combien de fois vous vous lavez les mains avec de l'eau et du savon?

1 jamais
2 rarement (une fois par semaine)
3 quelquefois (1-2 fois par jour)
4 souvent (2-5 fois par jour)
5 toujours (dans tous les situations cibles)

Avant d'allaiter un enfant, combien de fois vous vous lavez les mains avec de l'eau et du savon?

1 jamais
2 rarement (une fois par semaine)
3 quelquefois (1-2 fois par jour)
4 souvent (2-5 fois par jour)
5 toujours (dans tous les situations cibles)

Avant de manier de l'eau potable, combien de fois vous vous lavez les mains avec de l'eau et du savon?

1 jamais
2 rarement (une fois par semaine)
3 quelquefois (1-2 fois par jour)
4 souvent (2-5 fois par jour)
5 toujours (dans tous les situations cibles)

Après avoir mangé, combien de fois vous lavez-vous les mains avec de l'eau et du savon?

1 jamais
2 rarement (une fois par semaine)
3 quelquefois (1-2 fois par jour)
4 souvent (2-5 fois par jour)
5 toujours (dans tous les situations cibles)

Après avoir déféqué, combien de fois vous vous lavez les mains avec de l'eau et du savon?

1 jamais
2 rarement (une fois par semaine)
3 quelquefois (1-2 fois par jour)
4 souvent (2-5 fois par jour)
5 toujours (dans tous les situations cibles)

Après avoir nettoyé un enfant, combien de fois vous vous lavez les mains avec de l'eau et du savon?

1 jamais
2 rarement (une fois par semaine)
3 quelquefois (1-2 fois par jour)
4 souvent (2-5 fois par jour)
5 toujours (dans tous les situations cibles)

Après d'autres contacts avec des selles, combien de fois vous vous lavez les mains avec de l'eau et du savon?

1 jamais
2 rarement (une fois par semaine)
3 quelquefois (1-2 fois par jour)
4 souvent (2-5 fois par jour)
5 toujours (dans tous les situations cibles)

SVP faites une bonne estimation: Combien de fois quelque chose vous empêche de vous laver les mains avec de l'eau et du savon?

1 jamais
2 rarement (une fois par semaine)
3 quelquefois (1-2 fois par jour)
4 souvent (2-5 fois par jour)
5 toujours (dans tous les situations cibles)

Combien de fois avez-vous lavé les mains avec de l'eau et du savon pendant les dernières 24 heures?

Quand vous pensez aux dernières 24 heures: combien de fois est-il arrivé que vous avez oublié de vous laver les mains même si vous aviez eu l'intention de le faire?

1 jamais
2 dans moins que la moitié de fois
3 dans la moitié de fois
4 dans plus que la moitié de fois
5 toujours

Comparé à un ménage moyen, pensez vous qu'on se lave les mains plus souvent ou moins souvent chez vous?

1 beacoup moins souvent
2 moins souvent
3 à peu prêt pareil
4 plus souvent
5 beaucoup plus souvent

Maintenant, nous aimerions connaître certaines de vos attitudes et pensées sur le lavage des mains. Encore une fois, il n'est pas important comment ou combien de fois vous le faitez actuellement, nous sommes seulement intéressés en ce que vous d'en pensez.

Compte tenu des coûts et du temps nécessaires pour exécuter le lavage des mains, quel effort devez vous fournir pour vous laver les mains avec de l'eau et du savon?

1 pas d'effort du tout
2 un peu d'effort
3 moyennement d'effort
4 assez d'effort
5 beaucoup d'effort

Compte tenu de tous les coûtes et efforts, ainsi que les avantages liés au lavage des mains avec de l'eau et du savon, dans quelle mesure pensez-vous qu'il y a de la valeur de le faire?

1 pas du tout de valeur
2 un peu de valeur
3 moyennement de valeur
4 assez de valeur
5 beaucoup de valeur

Dans quelle mesure êtes-vous certain que le lavage des mains avec de l'eau et du savon peut empêcher vous et votre famille d'avoir la diarrhée?

1 pas du tout certain
2 un peu certain
3 moyennement certain

4 assez certain
5 très certain

Combien aimez-vous ou n'aimez-vous pas vous laver les mains avec de l'eau et du savon?

1 ne l'aime pas du tout
2 ne l'aime pas assez
3 neutre
4 l'aime assez
5 l'aime beaucoup

Pensez-vous que c'est dégoûtant de ne pas se laver les mains avec de l'eau et du savon après la défécation?

1 pas du tout
2 un peu
3 moyen
4 assez
5 beaucoup

Pensez-vous que c'est dégoûtant de se frotter les deux mains pour le lavage des mains?

0 Non
1 Oui

Selon vous, combien de personnes de votre communauté se lavent les mains avec de l'eau et du savon après la défécation?

1 (presque) personne
2 moins que la moitié des gens
3 la moitié des gens
4 plus que la moitié des gens
5 (presque) tout le monde
10 ne sais pas

Les gens qui sont importants pour vous, combien se soucient-ils de savoir si vous vous lavez ou pas les mains à l'eau et au savon après la défécation?

1 pas du tout
2 un peu
3 moyen
4 assez
5 beaucoup

Dans quelle mesure sentez-vous une obligation personnelle de se laver les mains avec de l'eau et du savon après la défécation?

1 pas du tout
2 un peu
3 moyen

4 assez
5 beaucoup

Dans votre famille, vous rappelez-vous les uns aux autres de vous laver les mains avec de l'eau et du savon?

1 pas du tout
2 un peu
3 moyen
4 assez
5 beaucoup

Lorsque on en vient à dépenser de l'argent pour acheter du savon, est ce que le chef du ménage offre son aide lorsque vous en avez besoin ?

1 pas du tout
2 un peu
3 moyen
4 assez
5 beaucoup

Dans quelle mesure êtes vous certain que vous serez toujours capable de vous laver les mains avec de l'eau et du savon après la défécation?

1 pas du tout certain
2 un peu certain
3 moyennement certain
4 assez certain
5 très certain

Dans quelle mesure est-il difficile pour vous d'obtenir autant d'eau et de savon que vous avez besoin pour toujours vous laver les mains avec de l'eau et du savon après la défécation?

1 pas du tout difficile
2 un peu difficile
3 moyennement difficile
4 assez difficile
5 très difficile

Dans quelle mesure êtes-vous confiant que vous serez capable de vous laver les mains avec de l'eau et du savon, même si les tâches urgentes interfèrent?

1 pas du tout confiant
2 un peu confiant
3 moyennement confiant
4 assez confiant
5 très confiant

Est-ce que vous avez des plans comment s'assurer que vous pouvez toujours vous laver les mains avec de l'eau et du savon dans les situations importants? Parlez-moi d'eux.

Enquêteur : C'est une question ouverte! NE lisez PAS les réponses! Marquez seulement ce qui est mentionné par la personne. Plusieurs réponses possibles.
0 PAS de plan
1 QUI va le faire
2 QUOI est nécessaire
3 COMMENT c'est fait
4 OÙ il est fait
5 QUAND il est fait
6 COMBIEN DE FOIS il est fait

Votre intention de toujours vous laver les mains avec de l'eau et du savon après la défécation, elle est de quel degrè?

1 très faible
2 assez faible
3 ni faible ni fort
4 assez fort
5 très fort

Votre intention de toujours vous laver les mains avec de l'eau et du savon avant de manger, elle est de quel degrè?

1 très faible
2 assez faible
3 ni faible ni fort
4 assez fort
5 très fort

Combien avez-vous fait attention de ne pas oublier de se laver les mains au cours de la dernière semaine?

1 pas du tout
2 un peu
3 moyen
4 assez
5 beaucoup

SVP racontez nous des difficultés de se laver les mains.

Est-ce qu'il y a des difficultés spécifique qui interfèrent ou peuvent interférer avec votre intention de vous laver les mains regulièrement?

0 Non
1 Oui

Quelles sont les difficultés spécifiques que vous voyez susceptible d'interférer avec votre intention de vous laver les mains?

Avez-vous un plan spécifique sur comment faire face à cettes difficultés? SVP, dites-moi comment régliez-vous ce problème?

Enquêteur: SVP jugez, s'il existe un plan comment faire face aux difficultés.
0 Non
1 Oui
3 ne sais pas

Dans quelle mesure est-il important pour vous de vous laver les mains avec de l'eau et du savon?

1 pas du tout important
2 un peu important
3 moyennement important
4 assez important
5 très important

Dans quelle mesure vous sentez-vous engagés à vous laver les mains avec de l'eau et du savon?

1 pas du tout dévoué
2 un peu dévoué
3 moyennement dévoué
4 assez dévoué
5 très dévoué

Dans quelle mesure pensez-vous que laver les mains avec de l'eau et du savon, c'est quelque chose d'habitude pour vous?

1 pas du tout d'habitude
2 un peu d'habitude
3 moyennement d'habitude
4 assez d'habitude
5 très d'habitude

Dans quelle mesure lavez-vous les mains plutôt automatiquement après la défécation, sans en penser directement?

1 pas du tout automatiquement
2 un peu automatiquement
3 moyennement automatiquement
4 assez automatiquement
5 très automatiquement

Latrine

Maintenant, pouvez-vous nous dire quelques détails sur votre situation de latrine.

Où défécez vous d'habitude?

1 à l'air libre
2 latrine publique
3 latrine partagée
4 latrine privée
9 autre
SVP specifier autre.

Avec combien de familles partagez-vous la latrine?

La latrine que vous utilisez d'habitude, se trouve à quelle distance de votre ménage?

1 se trouve dans le ménage
2 jusqu'à 50 m du ménage
3 50-250 m du ménage
4 250-500 m du ménage
5 500-1000 m du ménage
6 plus que 1 km du ménage

Combien de temps vous faut-il pour y aller, attendre si nécessaire et revenir?

1 moins qu'une minute
2 1-5 minutes
3 5-15 minutes
4 15-30 minutes
5 30-60 minutes
6 plus qu'une heure

Enquêteur: SVP prendre une photo de la latrine si la latrine se trouve dans le ménage.

Enquêteur: SVP noter la latrine si visible.

1 latrine simple
2 latrine ameliorée
3 aire libre
9 autre
SVP specifier autre.

Combien de fois utilisez-vous cette latrine d'habitude?

1 toujours
2 quelquefois
3 jamais
9 ne sais pas

Combien de fois utilisez-vous une autre latrine que celle d'habitude?

1 toujours
2 quelquefois

3 jamais
9 ne sais pas

Combien de fois vous arrive t-il de ne pas utiliser une latrine?

1 toujours
2 quelquefois
3 jamais
9 ne sais pas

santé générale

Maintenant je vais vous poser quelques questions sur l'état de la santé de votre famille.

Quand vous pensez à la situation actuelle de santé de votre famille, dans quelle mesure êtes-vous contenté?

1 complètement insatisfait
2 assez insatisfait
3 ni insatisfait ni satisfait
4 assez satisfait
5 complètement satisfait

Si vous comparez la situation de santé actuelle de votre famille avec celle d'une famille moyenne de votre communauté, est-ce vous pensez que la votre c'est mieux ou pire?

1 beaucoup pire
2 un peu pire
3 à peu près la même
4 un peu mieux
5 beacoup mieux

Si vous pensez à la situation future de santé de votre famille, êtes-vous anxieux?

1 pas du tout anxieux
2 un peu anxieux
3 moyennement anxieux
4 assez anxieux
5 très anxieux

Dans la prochaine section je vais poser des questions sur la diarrhée et le risque de diarrhée.

Combien de personnes de votre ménage ont souffert de diarrhée pendant la semaine passée?

Votre enfant de moins de 5 ans, a-t-il souffert de diarrhée pendant la semaine passée?

0 Non
1 Oui

Combien de fois votre enfant de moins de 5 ans souffre-t-il de diarrhée en général?

1 jamais
2 plusieurs fois par an
3 plusieurs fois par mois
4 plusieurs fois par semaine
5 presque tous les jours

Quelles sont les maladies qui affectent le plus souvent votre famille?

Plusieurs réponses possibles.
0 rien
1 diarrhée
2 choléra
3 paludisme
4 respiratoire
5 trachome
6 rhume
9 autre
SVP specifier autre.

Combien de personnes de votre ménage ont souffert de choléra?

En suite quelques question sur votre risque, ca veut dire la probabilité de tomber malade de diarrhée. SVP répondez seulement ce que vous même pensez et ne pas les opinions d'autres ou ce que vous pensez doit être la réponse correcte. C'est toujours votre opinion que nous intéresse. Quand on parle de diarrhée nous comprenons le passage de 3 selles liquides ou plus dans les dernières 24 heures avec ou sans la déshydratation.

En général, que pensez-vous est votre risque d'attraper la diarrhée?

1 très bas
2 bas
3 moyen
4 élevé
5 très élevé

Selon vous, quel est le risque pour une personne de votre communauté d'attraper la diarrhée?

1 très bas
2 bas
3 moyen
4 élevé
5 très élevé

Selon vous, quel est le risque pour votre enfant de moins de 5 ans d'attraper la diarrhée?

1 très bas
2 bas
3 moyen

4 élevé
5 très élevé

En général, que pensez-vous de votre risque d'attraper le choléra?

1 très bas
2 bas
3 moyen
4 élevé
5 très élevé

Selon vous, quel est le risque pour votre enfant de moins de 5 ans d'attraper le cholera?

1 très bas
2 bas
3 moyen
4 élevé
5 très élevé

Selon vous, quel serait votre risque d'attraper la diarrhée si vous NE traitez PAS votre eau destinée à la boison?

1 très bas
2 bas
3 moyen
4 élevé
5 très élevé

Selon vous, quel serait votre risque d'attraper la diarrhée si vous traitez TOUJOURS votre eau destinée à la boison?

1 très bas
2 bas
3 moyen
4 élevé
5 très élevé

Selon vous, quel serait votre risque d'attraper la diarrhée si vous NE vous lavez JAMAIS les mains avant de manger ou préparer les aliments et après la défécation?

1 très bas
2 bas
3 moyen
4 élevé
5 très élevé

Selon vous, quel serait votre risque d'attraper la diarrhée si vous vous lavez TOUJOURS les mains avant de manger ou préparer les aliments et après la défécation?

1 très bas
2 bas
3 moyen
4 élevé
5 très élevé

Selon vous, quel est votre risque d'attraper la diarrhée selon votre comportement actuel de traitement de l'eau et de lavage des mains?

1 très bas
2 bas
3 moyen
4 élevé
5 très élevé

Quand vous avez attrapé la diarrhée, quel est l'effet sur votre vie en général selon votre estime?

1 pas du tout sévère
2 un peu sévère
3 moyennement sévère
4 assez sévère
5 très sévère

Quand votre enfant de moins de 5 ans a attrapé la diarrhée, quel est l'effet sur sa santé selon votre estime?

1 pas du tout sévère
2 un peu sévère
3 moyennement sévère
4 assez sévère
5 très sévère

Quelles sont les causes les plus importantes de la diarrhée?

Enquêteur : C'est une question ouverte! NE lisez PAS les réponses! Marquez seulement ce qui est mentionné par la personne. Plusieurs réponses possibles.
1 saleté de l'eau
2 microbes dans l'eau
3 saleté des mains
4 nourriture pas bien preparé ou stocké
5 nourriture gaté
6 paludisme
7 Dieu/Allah
8 manque d'hygiène
11 froid
12 dentation de l'enfant
9 autre

10 ne sais pas
SVP spécifiez autre.

Quels sont les effets les plus importants de la diarrhée sur votre corps?

Enquêteur : C'est une question ouverte! NE lisez PAS les réponses! Marquez seulement ce qui est mentionné par la personne. Plusieurs réponses possibles.
1 fatigue
2 faiblesse
3 vertige
4 fievre
5 mal à tête
6 mal au ventre
7 dehydratation/perte de l'eau
8 pas d'appetite
11 yeux pales
12 peau seche
13 mort
9 autre
10 ne sais pas
SVP spécifiez autre.

Quelles sont les mesures de traitement les plus importantes de la diarrhée?

Enquêteur : C'est une question ouverte! NE lisez PAS les réponses! Marquez seulement ce qui est mentionné par la personne. Plusieurs réponses possibles.
1 boire de l'eau sûre
2 boire de l'eau avec sucre/sel/jus de citron
3 boire le thé de tissane ou racines
4 solution de réhydratation orale/oracel
5 manger legèrement
6 se reposer
7 médicaments
8 hôpital/docteur
9 autre
10 ne sais pas
SVP spécifiez autre.

Quelles sont les mesures de prévention les plus importantes de la diarrhée?

Enquêteur : C'est une question ouverte! NE lisez PAS les réponses! Marquez seulement ce qui est mentionné par la personne. Plusieurs réponses possibles.
1 laver les mains avec de l'eau et savon dans les situations clés
2 boire de l'eau propre
3 boire de l'eau traité
4 laver les aliments avant de manger
5 manger seulement ce qui était boulli ou pelé avant de la consommation
6 nettoyer la maison
7 utiliser une latrine propre
8 laver et stockés les vaisalles d'une manière securisé
11 avoir des médicaments à la maison

12 stocker l'eau d'une manière securisé
9 autre
10 ne sais pas
SVP spécifiez autre.

Dans cette année, est-ce que vous avez suivi des campagnes sur la prévention de la diarrhée autre que cela par le CSSI/EAWAG/OMS/MSP?

0 Non
1 Oui
3 ne sais pas

De quel type de campagne il s'agit, qui l'a organisé, et quels étaient les messages les plus importants?

Test de connaissance

Ceci est un test de connaissances sur le traitement de l'eau. Veuillez répondre SVP si les affirmations suivantes sont correctes.

Faire bouillir l'eau est une option sûre pour traiter l'eau destinée à la boison.

1 correcte
2 incorrecte

L'eau qui n'a pas de saleté visuelle en elle est potable.

1 correcte
2 incorrecte

Le chlore (eau de javel) est la seule option sûre pour produire l'eau potable.

1 correcte
2 incorrecte

Ce n'est pas important si le récipient de stockage d'eau est couvert ou pas.

1 correcte
2 incorrecte

Lorsque l'eau est refroidie au frigo pendant au moins une nuit, il est sûr de la boire.

1 correcte
2 incorrecte

Après chloration (ajouter eau de javel), vous devez attendre au moins 30 min pour que l'eau devienne potable.

1 correcte
2 incorrecte

Il n'est pas nécessaire de se laver les mains avec de l'eau et du savon avant de cuisiner.

1 correcte
2 incorrecte

L'eau peut être consommée directement après que le chlore (eau de javel) a été ajouté.

1 correcte
2 incorrecte

La lumière du soleil peut désinfecter l'eau lorsque la bouteille en plastique est mise en lumière directe du soleil pendant deux heures.

1 correcte
2 incorrecte

Il est important de laver tous les utensiles avec de l'eau et du savon avant de les utiliser.

1 correcte
2 incorrecte

Les aliments qui semble propre ne causeront pas la diarrhée.

1 correcte
2 incorrecte

Intervention check

SVP informez la répondante que on va parler maintenant des activités de promotion des Relais Communautaire pendant les mois de juin et juillet dans ce communauté.

Est-ce que vous étiez au courant des séances organisé par les Relais Communautaires de votre centre de santé en collaboration avec le CSSI, l'EAWAG, le Ministère de la Santé et l'OMS qui ont eu comme thème le traitement de l'eau et le lavage des mains?

0 Non
1 Oui

Comment vous-étiez informé?

Plusieurs réponses possible
1 par téléphone
2 par promotion porte-à-porte
3 par les supérieurs/chefs
4 autres réunions
5 par les voisins
9 autre
Si autre, comment?

Est-ce que vous étiez invité à participer à cettes séances?

0 Non
1 Oui

Qui vous a invité?

Plusieurs réponses possible
1 Relais Communautaire
2 Chef Centre de Santé
3 Chef de carré/quartier
4 voisins
9 autre
Si autre, comment?

Est-ce que quelqu'un de votre ménage a participé aux séances organisé par les Relais Communautaires de votre centre de santé qui ont eu comme thème le traitement de l'eau ou le lavage des mains?

0 Non
1 Oui

Pourquoi pas?

Quelle(s) personne(s) de votre ménage ont participé aux séances?

1 épouse
2 fille
3 mère
4 soeur
5 fils
6 père
7 frère
8 chef du ménage
9 autre
Si autre, qui?

Vous avez participé à combien de séances en total?

Quel était le thème global des séances visités?

1 traitement d'eau
2 lavage des mains
9 autre
Si autre, lequel?

Quels étaient les messages principales des ces réunions?

Enquêteur : C'est une question ouverte! NE lisez PAS les réponses! Marquez seulement ce qui est mentionné par la personne. Plusieurs réponses possibles.
1 les voies de transmission du choléra et autres maladies diarrhéiques
2 comment eviter le choléra, couper les voies de transmission
3 l'importance du lavage des mains

4 l'importance du traitement de l'eau
5 l'importance d'utilisation des latrines
6 l'importance de l'enagement personnelle
7 comment maîtriser le traitement de l'eau
8 comment produire la solution mère
10 comment construire une station lavage des mains
9 autre
Si autres, lequels?

Quels activités vous avez suivi pendantles séances?

Enquêteur : C'est une question ouverte! NE lisez PAS les réponses! Marquez seulement ce qui est mentionné par la personne. Plusieurs réponses possibles.
1 spot
2 poster
3 démonstration pratique
4 engagement public
5 discussion en groupe
9 autre
Si autre, lequel?

Avez-vous écouté le spot enregistré?

0 Non
1 Oui

Avez-vous vu le poster?

0 Non
1 Oui

Avez-vous suivi la séance de démonstration pratique?

0 Non
1 Oui

Avez-vous suivi l'appel sur l'enagagment personelle?

0 Non
1 Oui

Est-ce que vous avez pris un engagement personelle par rapport au traitement de l'eau à la maison?

0 Non
1 Oui

Pourquoi?

Pourquoi pas?

Selon votre estimation, combien de personnes ont pris un enagagement personelle lors de la séances pour le traitement de l'eau?

1 personne
2 une minorité
3 la moitié
4 une majorité
5 presque tous le monde

Après cette séance, pensez-vous plus positivement, négativement ou la même chose au sujet du traitement de l'eau?

1 beaucoup plus negative
2 plus negative
3 plus ou moins le même
4 plus positif
5 beaucoup plus positif

Est-ce que vous avez augmenté les efforts à effectuer le traitement de l'eau après avoir visité les séances?

0 Non
1 Oui

Pourquoi?

Pourquoi pas?

Est-ce que vous avez pris un engagement personelle par rapport au lavage des mains?

0 Non
1 Oui

Pourquoi?

Pourquoi pas?

Après cette séance, pensez-vous plus positivement, négativement ou la même chose au sujet du lavage des mains avec de l'eau et du savon?

1 beaucoup plus negative
2 plus negative
3 plus ou moins le même
4 plus positif
5 beaucoup plus positif

Est-ce que vous avez construit une station de lavage des mains?

0 Non
1 Oui

Pourquoi?

Pourquoi pas?

Selon votre estimation, combien de personnes ont construit une station de lavage des mains lors de la séances?

1 personne
2 une minorité
3 la moitié
4 une majorité
5 presque tous le monde

Est-ce vous avez affiché le signe d'engagament à la maison?

0 Non
1 Oui

Pourquoi?

Pourquoi pas?

Combien de maisons dans votre quartier est-ce-que vous avez vue avec ce signe d'engagement ?

1 personne
2 une minorité
3 la moitié
4 une majorité
5 presque tous le monde

Qu'est-ce qui signifie le signe d'engagement pour vous?

Enquêteur, SVP observez le suivant.

Est-ce qu'un signe d'engagement est bien visible dans le ménage?

0 Non
1 Oui, mais à l'interieur
2 Oui, bien visible à l'exterieur

Est-ce que la station de lavage des mains est bien visible/identifiable?

0 Non
1 Oui

Est-ce que'on peut observer du matériel pour le traitement de l'eau (eau de javel) dans le ménage?

0 Non
1 Oui, eau de javel
9 autre
Si autre, lequel?

Observations rapides

J'aimerais bien faire un tour de votre ménage, faire des observations et prendre quelques images, si vous êtes d'accord.

Quelle est la situation de l'hygiène dans le ménage?

Enquêteur: Vous avez déjà observé certaines choses pendant l'interview! Profitez!

Est-ce que la mère semble être propre?

0 Non
1 Oui
3 pas vue

Les mains de la mère sont-elles propres?

0 Non
1 Oui
3 pas vue

Les doigts de la mère sont-ils propres?

0 Non
1 Oui
3 pas vue

Les ongles de la mère sont-ils propres?

0 Non
1 Oui
3 pas vue

Est-ce que la mère porte des chaussures?

0 Non
1 Oui
3 pas vue

L'enfant cible semble être propre?

0 Non
1 Oui
3 pas vue

Les mains de l'enfant cible sont-elles propres?

0 Non
1 Oui
3 pas vue

Les doigts de l'enfant cible sont-ils propres?

0 Non
1 Oui
3 pas vue

Le visage de l'enfant cible est-il propre?

0 Non
1 Oui
3 pas vue

Est-ce que la couche de bébé/ la culotte de l'enfant est propre?

0 Non
1 Oui
3 pas vue

Est-ce que le visage de l'enfant cible est sans décharge des yeux ou du nez?

0 Non
1 Oui
3 pas vue

Est-ce que l'enfant cible porte des chaussures?

0 Non
1 Oui
3 pas vue

Est-ce que la maison est balayée de la saleté?

0 Non
1 Oui
3 pas vue

Est-ce qu'il y a des ordures à l'intérieur ou aux alentours de à la maison?

0 Non
1 Oui
3 pas vue

Est-ce qu'il y a des animaux sans retenue à l'intérieur ou aux alentours de la maison?

0 Non
1 Oui
3 pas vue

Y a-t-il beaucoup de mouches (plus de 5) dans la maison?

0 Non
1 Oui
3 pas vue

Y a-t-il des excréments des annimeaux à l'intérieur ou aux alentours de la maison?

0 Non
1 Oui
3 pas vue

Y a-t-il des excréments humaines à l'intérieur ou aux alentours de la maison?

0 Non
1 Oui
3 pas vue

Y a-t-il de l'eau stagnante à l'intérieur ou aux alentours de la maison?

0 Non
1 Oui
3 pas vue

Y a-t-il des vaiselles pas lavées à l'intérieur de la maison?

0 Non
1 Oui
3 pas vue

Les plats, sont-ils stockés au dessus du sol?

0 Non
1 Oui
3 pas vue

Y a-t-il de l'eau potable disponible?

0 Non
1 Oui
3 pas vue

Est-ce que le réservoir d'eau potable est fermé?

0 Non
1 Oui
3 pas vue

Est-ce que le récipient de collecte de l'eau a une petite ouverture (<5 cm) ou tourillon?

0 Non
1 Oui
3 pas vue

Est-ce que le réservoir d'eau est propre de la saleté visible?

0 Non
1 Oui
3 pas vue

Le ménage a-t-il un endroit désigné pour le lavage des mains?

0 Non
1 Oui
3 pas vue

Est-ce que l'installation permet le lavage et le rinçage des deux mains sans assistance?

0 Non
1 Oui
3 pas vue

Y a-t-il de l'eau disponible au lieu de lavage des mains désigné?

0 Non
1 Oui
3 pas vue

Est-ce qu'il y a du savon disponible sur le lieu de lavage des mains désigné?

0 Non
1 Oui
3 pas vue

Est-ce qu'il y a d'autres agents (cendre, sable) de lavage disponibles sur le lieu de lavage des mains désigné?

0 Non
1 Oui
3 pas vue

Est-ce qu'il y a une latrine dans le ménage/la concession?

0 Non
1 Oui
3 pas vue

Est-ce que la latrine a une porte?

0 Non
1 Oui
3 pas vue

Est-ce que les latrines ont des parois qui sont suffisamment élevée pour permettre l'utilisation privée?

0 Non
1 Oui
3 pas vue

Si la latrine est sans chasse d'eau, est-ce que le trou a un couvercle?

0 Non
1 Oui
3 pas vue

Si la latrine est avec chasse d'eau, est-ce qu-il y a de l'eau?

0 Non
1 Oui
3 pas vue

Le sol de la latrine, est-il propre des excréments et de la saleté?

0 Non
1 Oui
3 pas vue

Y at-il des preuves de l'utilisation récente de la latrine? (excréments visibles dans la fosse, l'eau pour le lavage des mains, etc)

0 Non
1 Oui
3 pas vue

Est-ce qu'il y de l'eau et su savon proche de la latrine?

0 Non
1 Oui
3 pas vue

Est-ce qu'il y a plus de 5 moches dans la latrine?

0 Non
1 Oui
3 pas vue

Est-ce que le ménage possède les objets suivant?

...un lit?

0 Non
1 Oui, en fonction
2 Oui, mais ne marche pas ou cassé
3 ne sais pas

...une table?

0 Non
1 Oui, en fonction
2 Oui, mais ne marche pas ou cassé
3 ne sais pas

...de l'électricité

0 Non
1 Oui, en fonction
2 Oui, mais ne marche pas ou cassé
3 ne sais pas

...une radio?

0 Non
1 Oui, en fonction
2 Oui, mais ne marche pas ou cassé
3 ne sais pas

...la télévision?

0 Non
1 Oui, en fonction
2 Oui, mais ne marche pas ou cassé
3 ne sais pas

...un frigo?

0 Non
1 Oui, en fonction
2 Oui, mais ne marche pas ou cassé
3 ne sais pas

...une moto ou une voiture?

0 Non
1 Oui, en fonction
2 Oui, mais ne marche pas ou cassé
3 ne sais pas

...un téléphone (portable)?

0 Non
1 Oui, en fonction
2 Oui, mais ne marche pas ou cassé
3 ne sais pas

Enquêteur: SVP prendre une photo de la maison.

Quel est le type de logement?

1 en terre
2 semi-dure
3 dure
4 bailotte
9 autre
SVP specifier autre

Debriefing

Merci beaucoup pour votre temps et collaboration. Vous nous avez beaucoup aidé afin de mieux comprendre la sitaution d'hygiène et assainissement au niveau des ménages. La première enquête avait le but de nous assister au developpement des interventions qui ont déjà pris place dans quelques communautés du Tchad. Ces activités menées par les Relaic communautaires ont contenu des informations sur le voies de transmission de la diarrhée et le choléra ainsi les options pour se proteger comme le traitment de l'eau et le lavage des mains regulière avec de l'eau et du savon. Si votre communauté n'a pas encore reçu ces informations, les Relais chez vous vont très bientôt organiser des réunions pourque vous pouvez en profiter également. Merci encore une fois pour votre aimable collaboration.

Appendix D

Curriculum vitae

Personal information

Jonathan Lucas Lilje; born 01.12.1985 in Berlin; married, one child
Katzgasse 6a; D - 78462 Konstanz; Jonathan_lilje@yahoo.com

Current position

- since 08/2013 Research assistant at Eawag: Swiss Federal Institute of Aquatic Science and Technology

- Project leader “Providing and evaluating evidence-based water, sanitation and hygiene behavioral interventions for prevention and control of cholera" in Chad/Cameroon in collaboration World Health Organization

- Project leader “Handwashing Campaign in rural Zimbabwe" in collaboration with Swiss Development Cooperation

- PhD work title: “Providing and evaluating evidence-based water, sanitation and hygiene behavioral interventions for prevention and control of cholera"

Publications & Conferences

- Lilje, J & Mosler, H.-J. (2017). Effects of a behavior change campaign on household water disinfection in the Lake Chad basin using the RANAS approach. Science of the Total Environment, https://doi.org/10.1016/j.scitotenv.2017.10.142

- Lilje, J & Mosler, H.-J. (2017). Socio-psychological determinants for safe drinking water consumption behaviors: a multi-country review. Journal of Water Sanitation and Hygiene for Development 7 - 1

- Lilje, J & Mosler, H.-J. (2016). Continuation of health behaviors: Psychosocial factors sustaining drinking water chlorination in a longitudinal study from Chad. Sustainability, 8 - 11

- Lilje, J., Kessely, H., & Mosler, H.-J. (2015). Factors Determining Water Treatment Behavior for the Prevention of Cholera in Chad. The American Journal of Tropical Medicine and Hygiene, 14-0613.

- Talk at the annual Water and Health Conference 2017 at UNC; North Carolina, USA; Title “Effects of a behavior change campaign on household water disinfection in the Lake Chad basin using the RANAS approach"
- Talk at the annual Water and Health Conference 2016 at UNC; North Carolina, USA; Title “Continuation of health behaviors: Psychosocial factors sustaining drinking water chlorination in a longitudinal study from Chad"
- Talk at the annual Water and Health Conference 2014 at UNC; North Carolina, USA; Title “Factors Determining Water Treatment Behavior for the Prevention of Cholera in Chad"
- Poster presentation on Society for Neuroscience conference 2012 in New Orleans, LA, USA; Title “Auditory processing during human slow wave sleep"

Education

- Since 01/2013 Training in psychological counseling with the Organization for Systemic Therapy, Supervision, and Education in Mannheim, Germany
- 10/2010 - 03/2013 Master of Science in Psychology at Albert-Ludwigs University, Freiburg im Breisgau, Germany final grade: 1,3
  Master’s thesis: “Auditory processing during human slow wave sleep"
- 10/2011 - 03/2012 Research semester in Neuropsychology at University of Konstanz, Germany
- 10/2007 - 08/2012 Bachelor of Science in Psychology at Albert-Ludwigs University, Freiburg im Breisgau, Germany final grade: 1,5
  Bachelor’s thesis: “Der Einfluss von Emotionen auf die sequentielle Konfliktverarbeitung"
- 10/2006 -08/2007 studies of human medicine at Charité-Universitätsmedizin, Berlin, Germany
- 07/2005 Abitur at Geschwister-Scholl-Schule, Konstanz, Germany major subjects: mathematics, chemistry, German, English, French
  final grade: 1,0

Past Activities

- 04/2011 - 07/2013 Student assistant job at IOmedico AG, Clinical Research Organisation (CRO), Freiburg im Brsg.; Development and design of questionnaires for Quality of Life research in the field of Oncology, statitiscal analysis and modeling of data, co-authoring in publications
- 04/2012 - 07/2012 Student assistant job at University of Freiburg, Germany, department of medical Psychology and Sociology; tutoring courses in the formation of ongoing doctors in the topic of foundations on scientific thinking and methodology in medical research

- 10/2011 - 03/2012 Research internship at University of Konstanz, Germany, department of Neuro-psychology; design, implementation, and statistical analysis of EEG sleep experiments on auditory processing, co-authoring in publications
- 02/2011 - 03/2011 Internship with IOmedico AG - Clinical Research Organisation (CRO), Freiburg im Brsg.; assistance and scientific counseling in the design of a clinical register study on Quality of Life and pain perception in oncological patients; research and analysis of scientific litertaure
- 10/2010 Psychological Counselor at Nachsorgeklinik Tannheim,Villingen-Schwenningen, Germany; rehabilitation hospital for families including their children suffering from chronic diseases; individual, familiy and group counseling
- 03/2010 - 04/2010 Internship with génération tiers monde at Douala, Cameroon; practical counseling and IT training of young employees in IT skills
- 06/2009 Organization of the German University Ultimate Frisbee Championships in Freiburg
- 10/2008 - 07/2010 Student assistant job at University of Freiburg, Germany, department of cognition sciences - DFG-Sonderforschungsbereich “spatial cognition"; design, implementation, and geo-statistical analysis of field studies on human spatial navigation
- 03/2009 - 04/2009 Internship at Nachsorgeklinik Tannheim,Villingen-Schwenningen, Germany; rehabilitation hospital for families including their children suffering from chronic diseases; assistance and counseling of teenagers with chronic disease, group therapy and relaxation approaches
- 04/2008 - 07/2008 Student assistant job at University of Freiburg, Germany, department of pedagogic psychology; assistance in studies on the design of learning environments
- 03/2007 Internship at Herzzentrum Bodensee, Konstanz, Germany; specialized hospital for cardiac diseases and surgery; assistance in nursing
- 06/2006 - 07/2006 Co-Organisation of Tribühne 06, Heidelberg, Germany; an intercultural project related to the football world championship 2006
- 03/2006 Internship at flyion GmbH, Tübingen, Germany; biotechnology start-up specialised in automated Patch-Clamping
- 01/2006 Internship at University Hospital, Hamburg-Eppendorf, Germany, department of pediatric cardiology
- 09/2005 - 10/2005 Educational journey to Marocco with “zis - Stiftung für Studienreisen"/UNESCO; report on “Dattelernte in Marokkos Oasen"
- 11/2005 - 12/2005 Stay abroad in Barcelona, Spain; visiting a language school
- 03/2003 - 11/2011 Volunteer work for Deutsches Youth for Understanding Komitee e.V., Hamburg, Germany; Organisation and administration of full-week preparation seminars for international youth exchange projects; Several years of consultant in the coordination team of YFU in Baden-Wuerttemberg

- 08/2002 - 06/2003 Stay abroad in East Hampton, CT, USA with Youth for Understanding, international student exchange program; visit of a local high school during one year

Qualifications

Languages

- native German, native
- English, French, fluent
- Spanish, Portuguese, Arabic, basic
- Latinum

IT

- MS-Word, Power Point, and Excel, good knowledge
- SPSS, good knowledge
- ADOBE Illustrator
- LATEX, basic knowledge

Others

- driver's licence classes B, M, L
- full-week instruction in first aid and emergency medicine
- training in the administration and conduction of full-week seminars in youth work programs and university courses

Personal Interests

- Ultimate Frisbee
- intercultural youth work and exchange programs
- creative design